CONTRACT DOCUMENTS and SPECIFICATIONS

CONTRACT 12 - WATER TREATMENT PLANT IMPROVEMENTS

FOR

LEBANON WATER WORKS COMPANY, INC.

SRF Loan No. F24-001S

SRF Project No. WX21155045

Kentucky Engineering Group, PLLC

P.O. Box 1034

Versailles, Kentucky 40383

August 2026

KEG Project No. 25006

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ADVERTISEMENT FOR BIDS

Lebanon Water Works Company, Inc.
120 South Proctor Knott Avenue
Lebanon, Kentucky 40033

Separate sealed Bids for the construction of the **Contract 12 - Water Treatment Plant Improvements** consisting of a new granular activated carbon(GAC) filtration facility and an onsite generation disinfection system as shown on the DRAWINGS and described in the SPECIFICATIONS will be received by Lebanon Water Works Company, Inc. at 120 South Proctor Knott Avenue, Lebanon, Kentucky 40033 until **10:00 am (EST Local Time) Thursday, September 24, 2026,** and then at said office publicly opened and read aloud.

A pre-bid conference is scheduled for Contract 12 at the water treatment plant on Thursday, September 10, 2026 @ 9:00 am.

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

The Contract Documents may be examined at the following locations:

KENTUCKY ENGINEERING GROUP, PLLC., 101 High Street, Versailles, Kentucky 40383
Phone: 859.251.4127

LEBANON WATER WORKS COMPANY, INC., 120 South Proctor Knott Avenue, Lebanon, Kentucky 40033. Phone: 270. 692.2491

Copies of the Contract Documents may be obtained from **LYNN IMAGING - Lexington** located at **328 Old Vine Street, Lexington, KY 40507, 859-255-1021, Website: www.lynnimaging.com**. Printed copies of the Contract Documents may be obtained upon receipt of a non-refundable amount of **$500.00** for each complete set of documents. Included with the printed copy of the contract documents is an electronic download (as portable document format PDF) upon request.

All bids must be made on required Bid Form and must be fully completed and executed with original signatures and corporate seals. All bidders must be listed as a plan holder by the plan distributor and Contract 10 bidders must attend the mandatory pre-bid meeting.

This project may be partially or entirely funded by the Kentucky Infrastructure Agency State Revolving Fund Loan.

Bidders must comply with President's Executive Orders No. 11246 and No. 11375 and any amendments or supplements to those Executive Orders. Attention of bidders is particularly called to the requirements as to conditions of employment to be observed under the contract, Section 3, Segregated Facility, Section 109 and E.O. 11246.

Bidders must certify they do not and will not maintain or provide for their employees any facilities that are segregated or based on race, color, creed or national origin. Bidders must comply with 41 CFR 60-4 in regard to affirmative action and to insure equal opportunity to females and minorities, and all that are applicable. Minorities and small businesses are encouraged to submit bids on this project.

Bidders must comply with Title VI of the Civil Rights Act of 1964 Anti-Kickback Act, and the Contract Work Hours Standard Act.

The procurement and performance of this contract are subject to the requirements of the Davis-Bacon Act.

Successful Bidder shall make positive efforts to use small, minority, women owned and disadvantaged businesses.

BUILD AMERICA BUY AMERICA REQUIREMENTS - The contractor acknowledges to and for the benefit of the Lebanon Water Works Company ("owner") and the Kentucky Infrastructure Authority (the "funding authority") that it understands the goods and services under this agreement are being funded with federal monies and have statutory requirements commonly known as "build America, buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the united states ("build America, buy America requirements") including iron and steel, manufactured products, and construction materials provided by the contactor pursuant to this agreement. The contractor hereby represents and warrants to and for the benefit of the owner and funding authority (a) the contractor has reviewed and understands the build America, buy America requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the united states in a manner that complies with the build America, buy America requirements, unless a waiver of the requirements is approved, and (c) the contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the build America, buy America requirements, as may be requested by the owner or the funding authority. Notwithstanding any other provision of this agreement, any failure to comply with this paragraph by the contractor shall permit the owner or funding authority to recover as damages against the contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the owner or funding authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the funding authority or any damages owed to the funding authority by the owner). If the contractor has no direct contractual privity with the funding authority, as a lender or awardee to the owner for the funding of its project, the owner and the contractor agree that the funding authority is a third-party beneficiary and neither this paragraph (nor any other provision of this agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the funding authority.

Lebanon Water Works Company, Inc., reserves the right to waive any bidding informalities and to reject any or all bids, for any reason. The right is reserved by the Owner, in the exercise of its sole judgment to reject any or all Bids, and to re-advertise and award the Contract in the regular manner or to waive any informalities, irregularities, mistakes, errors, or omissions in any Bid received and to accept any Bid deemed to be responsive to this invitation and favorable to interests of the Owner.

The sealed bid for this project shall be clearly marked on the outside of the envelope: "Sealed Bid for the **Contract 12 - Water Treatment Plant Improvements** for the Lebanon Water Works Company, Inc. The bid may be mailed to: Lebanon Water Works Company, Inc. 120 South Proctor Knott Avenue, Lebanon, Kentucky 40033. A certified check or Bid Bond payable to the Lebanon Water Works Company, Inc in the amount of five (5) percent of the Bid shall accompany the Bid.

John Turner, President Lebanon Water Works Company, Inc. Date: September 2026

INSTRUCTIONS TO BIDDERS

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ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. The term "Bidder" means one who submits a Bid directly to Owner, as distinct from a subbidder, who submits a bid to a Bidder. The term "Successful Bidder" means the lowest, qualified, responsible, and responsive Bidder to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award. The term "Bidding Documents" includes the Advertisement or Invitation to Bid, Instructions to Bidders, the Bid Form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents must be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid. Bids from anyone not on the Engineer's Plan Holders List will not be opened.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and the additional information listed in the Bid Form.

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

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

3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

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

4.01 *Site and Other Areas*

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

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4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. If there are reports and/or additional information concerning site conditions available, they will be included as Appendices to the Bidding Documents.

2. Geotechnical Report: If a Geotechnical Report is available, it will be included as an appendix to the Bidding Documents. The Geotechnical Report describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations.

The Conditions in the Geotechnical Report are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the said Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the Report, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are reported.

Nothing in the 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.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 *Site Visit and Testing by Bidders*

A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

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

C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing

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so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.

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

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

4.04 *Owner's Safety Program*

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

4.05 *Other Work at the Site*

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

ARTICLE 5 – BIDDER'S REPRESENTATIONS

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

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work included but not limited to the AIS requirements as mandated and any subsequent statutes mandating domestic preference which apply to 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

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Bidding Documents, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Bidding Documents, especially with respect to Technical Data in such reports and drawings;

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E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

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

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 – PRE-BID CONFERENCE

6.01 A mandatory pre-bid conference is scheduled for Contract 12 at the water treatment plant on Thursday, September 10, 2026 @ 9:00 am.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing via email to **rcarr@kyengr.com**. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five (5) percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a certified check, bank money order, or a Bid bond (on the form included in

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the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

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

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 91 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

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

ARTICLE 9 – CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Supplemental General Conditions and referred to in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, if 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 at least 15 days prior to the date for receipt of Bids in the case of a proposed substitute and 5 days prior in the case of a proposed "or-equal". Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions. 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 prospective Bidders. Bidders shall not rely upon approvals made in any other manner. Substitutes and "or-equal" materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.04 and 7.05 of the General conditions after the Effective Date of the contract.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as

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supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

11.03 If an award is made, Contractor shall be allowed to submit proposed substitutes and "or-equals" in accordance with the General Conditions.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

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

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

12.03 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

12.04 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SGC 7.06.

ARTICLE 13 – PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.

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

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

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

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

13.04 A Bid by an individual shall show the Bidder's name and official address.

13.05 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

13.06 All names shall be printed in ink below the signatures.

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

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

13.09 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form. 11.8. The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of any cash allowances named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.

The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of any cash allowances named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.

13.10 Each Bid must be submitted on the prescribed form and accompanied by the submittals listed in the Bid Form.

ARTICLE 14 – BASIS OF BID

14.01 Lump Sum

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

ARTICLE 15 – SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished 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 7 of the Bid Form.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope

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containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED."

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

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

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

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.

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

ARTICLE 17 – OPENING OF BIDS

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

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

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

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

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

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

ARTICLE 20 – BONDS AND INSURANCE

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

ARTICLE 21 – SIGNING OF AGREEMENT

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

ARTICLE 22 – NOT USED

ARTICLE 23 – NOT USED

ARTICLE 24 – POWER OF ATTORNEY

24.01 Attorneys-in-fact who sign Bid Bonds or Contract Bonds must file with each bond a certified and effective dated copy of their power of attorney.

ARTICLE 25 – LAWS AND REGULATIONS

25.01 The Bidder's attention is directed to the fact that all applicable State Laws, municipal ordinance, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

25.02 **BUILD AMERICA BUY AMERICA REQUIREMENTS** - The contractor acknowledges to and for the benefit of the Lebanon Water Works Company ("owner") and the Kentucky Infrastructure Authority (the "funding authority") that it understands the goods and services under this agreement are being funded with federal monies and have statutory requirements commonly known as "build America, buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the united states ("build America, buy America requirements") including iron and steel, manufactured products,

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and construction materials provided by the contactor pursuant to this agreement. The contractor hereby represents and warrants to and for the benefit of the owner and funding authority (a) the contractor has reviewed and understands the build America, buy America requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the united states in a manner that complies with the build America, buy America requirements, unless a waiver of the requirements is approved, and (c) the contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the build America, buy America requirements, as may be requested by the owner or the funding authority. Notwithstanding any other provision of this agreement, any failure to comply with this paragraph by the contractor shall permit the owner or funding authority to recover as damages against the contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the owner or funding authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the funding authority or any damages owed to the funding authority by the owner). If the contractor has no direct contractual privity with the funding authority, as a lender or awardee to the owner for the funding of its project, the owner and the contractor agree that the funding authority is a third-party beneficiary and neither this paragraph (nor any other provision of this agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the funding authority.

ARTICLE 26 – SAFETY STANDARDS AND ACCIDENT PREVENTION

26.01 With respect to all Work performed under this contract, the Contractor shall:

A. Comply with the safety standards provisions of applicable laws, building and construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596), and the requirements of Title 29 of the Code of Federal Regulations, Section 1518 as published in the "Federal Register", Volume 36, No. 75, Saturday, April 17, 1971.

B. Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.

C. Maintain at his/her office or other well-known place at the job site, all articles necessary for giving first aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or doctor's care of persons (including employees), who may be injured on the job site before the employer has made a standing arrangement for removal of injured persons to a hospital or a doctor's care.

ARTICLE 27 – WAGE RATE REQUIREMENTS

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

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ARTICLE 28 – DOW PROCUREMENT GUIDANCE

28.01 Contract will require cost, pricing, and certification for change order exceeding $100,000 as required by DOW Procurement Guidance for Construction and Equipment Contracts

ARTICLE 29 – USACE PERMIT

29.01 Should ancillary work completed by the contractor not specifically shown require it, the Contractor shall obtain a Section 404 permit from the Corp of Engineers.

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BID FORM

Contract 12 – Water Treatment Plant Improvements

Lebanon Water Works Company, Inc.

SRF Loan No. F24-001S

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Lebanon Water Works Company, Inc.

120 South Proctor Knott Avenue

Lebanon, Kentucky 40033

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

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

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

Addendum No.	Addendum, Date
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and

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drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

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

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

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

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

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

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

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

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

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

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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 e execution of the Contract.

ARTICLE 5 – BASIS OF BID

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

Notes 1. **In accordance with KRS 139.480(34) materials shall be tax exempt.** The contractor shall include all other applicable taxes and fees where required.

2. The lowest BIDDER will be determined based on the lowest Base Bid Contract Price.

3. The OWNER reserves the right to accept or reject any or all of the manufacturers proposed. Such acceptance or rejection may be based on technical or non-technical factors such as cost effectiveness, availability, service and parts, maintenance requirements, conformance to the project specifications, etc.

4. **AWARD OF THIS CONTRACT WILL BE BASED ON THE LOWEST RESPONSIBLE, RESPONSIVE BIDDER ON THE TOTAL OF THE BASE BID CONTRACT PRICE (INCLUDING BASE BID PLUS UNIT PRICE ITEMS & CASH ALLOWANCE).**

BASE BID PRICE: **$**_____

24" ∅ RAMMED AGGREGATE PIERS:	**860** **FT**	_____ **$/FT**	**=**	**$**	_____
6" ∅ MICROPILES* (through soil)*:	**820** **FT**	_____ **$/FT**	**=**	**$**	_____
6" ∅ MICROPILES (through rock)*:	**410** **FT**	_____ **$/FT**	**=**	**$**	_____
6" ∅ ROCK ANCHORS:	**370** **FT**	_____ **$/FT**	**=**	**$**	_____

***includes (1) pre-production test pile and (4) reaction piles**

CASH ALLOWANCE (GAC MEDIA): **$** **560,000.00**

CASH ALLOWANCE (eCOMM): **$** **8,000.00**

TOTAL BASE BID CONTRACT PRICE: **$**_____

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ARTICLE 6 – EQUIPMENT

6.01 Bidder shall enter in the space provided below the name of the manufacturer or brand of equipment which it proposes to furnish for each item of equipment listed. In order for the bid to be considered responsible and responsive, the manufacturer listed must be either the one listed in the specifications or an approved equal or substitution issued by addendum. This information will only be used to determine the responsiveness of the bid and in no way discourages request for substitute or "or equal" during the shop drawing review process. In the interest of open and free competition, at any time after the bid award, the contractor may request consideration of alternate manufacturers.

GAC Vessels	
On-site Sodium Hypo Generation	
Vertical Turbine Pumps	
Butterfly Valves	
Electric Valve Actuators	

6.02 The Contractor with the apparent low bid shall submit via email to rcarr@kyengr.com within approximately six (6) hours after the bid opening, no later than 4:00 p.m. (local time), the equipment manufacturer selections as indicated in Article 6 – Equipment, Section 6.01. All other documents listed in Section 8.01 shall be submitted with the Contractor's Bid.

ARTICLE 7 – TIME OF COMPLETION

7.01 Bidder agrees that the Work will be substantially complete within **_540_** calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **_570_** calendar days after the date when the Contract Times commence to run.

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

ARTICLE 8 – ATTACHMENTS TO THIS BID

8.01 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. List of Project References;

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

F. Required Bidder Qualification Statement with supporting data; and

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G. Manufacturer's Certification Letter (Attachment 15 SRF Supplemental General Conditions) on any approved "or equal" or substitute request to ensure compliance with AIS requirements and any subsequent statutes mandating domestic preference.

ARTICLE 9 – DEFINED TERMS

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

NOTE(S) TO USER:

Careful attention to proper use of terms defined in the Instructions to Bidders, the General Conditions, and Supplementary Conditions is most important.

ARTICLE 10 – BID SUBMITTAL

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

_____

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

_____

_____

Telephone Number: _____

Contact Name and e-mail address: _____

Bidder's License No.: _____
(where applicable)

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

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PROPOSED SUBCONTRACTORS AND SUPPLIERS

Each bidder shall enter, in the spaces provided, the names of major subcontractors and suppliers he proposes to employ and the classification or type of work that they will perform. Upon award of contract, the named subcontractors and suppliers shall be employed to perform the work, unless changes are specifically authorized by the Engineer.

A major subcontractor is defined as a subcontractor whose subcontract constitutes approximately three (3) per cent or more of the total contract amount.

Failure to furnish all information requested in this Questionnaire may be cause for rejection of the Bid.

LIST OF SUBCONTRACTORS

SUBCONTRACTOR'S /ADDRESS	**WORK DESCRIPTION/TOTAL VALUE**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

QUALIFICATIONS STATEMENT

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

1. SUBMITTED BY:

Official Name of Firm: _____

Address: _____

_____

_____

2. SUBMITTED TO: _____

3. SUBMITTED FOR: _____

Owner: Lebanon Water Works Company, Inc.

Project Name: 2024 WTP & System Improvements

Contract 12 - Water Treatment Plant Improvements

TYPE OF WORK: A new granular activated carbon (GAC) filtration facility and an onsite generation disinfection system.

CONTRACTOR'S CONTACT INFORMATION

Contact Person: _____

Title: _____

Phone: _____

Email: _____

4. AFFILIATED COMPANIES:

Name: _____

Address: _____

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5. **TYPE OF ORGANIZATION:**

☐ SOLE PROPRIETORSHIP

Name of Owner: _____

Doing Business As: _____

Date of Organization: _____

☐ PARTNERSHIP

Date of Organization: _____

Type of Partnership: _____

Name of General Partner(s): _____

_____

_____

☐ CORPORATION

State of Organization: _____

Date of Organization: _____

Executive Officers:

- President: _____

- Vice President(s): _____

_____

_____

- Treasurer: _____

- Secretary: _____

☐ LIMITED LIABILITY COMPANY

State of Organization: _____

Date of Organization: _____

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Members: _____

_____

_____

_____

☐ JOINT VENTURE

Sate of Organization: _____

Date of Organization: _____

Form of Organization: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

_____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

6. LICENSING

Jurisdiction: _____

Type of License: _____

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License Number: _____

Jurisdiction: _____

Type of License: _____

License Number: _____

7. CERTIFICATIONS CERTIFIED BY:

Disadvantage Business Enterprise: _____

Minority Business Enterprise: _____

Woman Owned Enterprise: _____

Small Business Enterprise: _____

Other (_____): _____

8. BONDING INFORMATION

Bonding Company: _____

Address: _____

_____

Bonding Agent: _____

Address: _____

_____

_____

Contact Name: _____

Phone: _____

Aggregate Bonding Capacity: _____

Available Bonding Capacity as of date of this submittal: _____

9. FINANCIAL INFORMATION

Financial Institution: _____

Address: _____

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Account Manager: _____

Phone: _____

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

10. CONSTRUCTION EXPERIENCE:

Current Experience:

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

Previous Experience:

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

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

☐ YES ☐ NO

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

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

☐ YES ☐ NO

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

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

☐ YES ☐ NO

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

11. SAFETY PROGRAM:

Name of Contractor's Safety Officer: _____

Include the following as attachments:

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

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

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

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

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

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

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

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

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

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

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

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

12. EQUIPMENT:

MAJOR EQUIPMENT:

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

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

NAME OF ORGANIZATION: _____

BY: _____

TITLE: _____

DATED: _____

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS _____ DAY OF _____, 20___

NOTARY PUBLIC - STATE OF _____

MY COMMISSION EXPIRES: _____

REQUIRED ATTACHMENTS

1. Schedule A (Current Experience).
2. Schedule B (Previous Experience).
3. Schedule C (Major Equipment).
4. Audited balance sheet for each of the last 3 years for firm named in Section 1.
5. Evidence of authority for individuals listed in Section 7 to bind organization to an agreement.
6. Resumes of officers and key individuals (including Safety Officer) of firm named in Section 1.
7. Required safety program submittals listed in Section 13.
8. Additional items as pertinent.

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SCHEDULE A

CURRENT EXPERIENCE

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

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SCHEDULE B

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

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

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SCHEDULE B

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

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

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SCHEDULE C - LIST OF MAJOR EQUIPMENT AVAILABLE

ITEM	PURCHASE DATE	CONDITION	ACQUIRED VALUE

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BID BOND

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

BIDDER *(Name and Address)*:

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

OWNER *(Name and Address)*: Lebanon Water Wors Company, Inc.
120 South Proctor Knott Avenue
Lebanon, Kentucky 40033

BID
Bid Due Date:
Description: 2024 WTP & System Improvements
Contract 12 - Water Treatment Plant Improvements

BOND
Bond Number:
Date:
Penal sum _____ $ _____
(Words) (Figures)

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

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
Title	Title

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

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and

assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

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

NOTICE OF AWARD

Owner:	Lebanon Water Works Company, Inc.	Owner's Contract No.:	12
Engineer:	Kentucky Engineering Group, PLLC	Engineer's Project No.:	25006
Project:	2024 WTP & System Improvements	Contract Name:	Water Treatment Plant Improvements

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated, 2026, for the above Contract, and that you are the Successful Bidder and are awarded a Contract for: 2024 WTP & System Improvements - Contract 12 - Water Treatment Plant Improvements

The Contract Price of the awarded Contract is: $_____

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

☒ a set of the Drawings will be delivered separately from the other Contract Documents.

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

1. Deliver to Owner [4] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

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

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

Owner: Lebanon Water Works Company, Inc.
Authorized Signature

By: _____

Date: _____

Title: President

Copy: Engineer

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

THIS AGREEMENT is by and between **Lebanon Water Works Company, Inc.** ("Owner") and

("Contractor").

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:

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **2024 WTP & System Improvements –** Contract 12 - **Water Treatment Plant Improvements.** Including a new a *new granular activated carbon (GAC) filtration facility and an onsite generation disinfection system* and all related appurtenances as shown on the DRAWINGS and described in the SPECIFICATIONS.

ARTICLE 3 – ENGINEER

3.01 The part of the Project that pertains to the Work has been designed by **Kentucky Engineering Group, PLLC.**

3.02 The Owner has retained **Kentucky Engineering Group, PLLC** ("Engineer") to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

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

4.02 *Contract Times: Days*

A. The Work will be substantially completed within 510 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 540 days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed

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and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Substantial Completion: Contractor shall pay Owner $ 500 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially completed.

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, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

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

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

a. 95 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. 100 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 95 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 150

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percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

.

6.03 *Final Payment*

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

ARTICLE 7 – INTEREST

7.01 All amounts not paid when due shall bear interest at the rate of *3.5* percent per annum.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

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

A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

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

C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.

E. 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.

F. 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.

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

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

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

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to 6, inclusive).
2. Performance bond (pages 1 to 3, inclusive).
3. Payment bond (pages 1 to 3, inclusive).
4. Other bonds.
   a. ___ (pages ___ to ___, inclusive).

NOTE(S) TO USER:

Such other bonds might include maintenance or warranty bonds intended to manage risk after completion of the Work.

5. General Conditions (pages 1 to 73, inclusive).
6. Supplementary Conditions (pages 1 to 8, inclusive).
7. Specifications as listed in the table of contents of the Project Manual.
8. Drawings (not attached but incorporated by reference) bearing the following general title: Contract 11 Water Treatment Plant Improvements **[or]** the Drawings listed on the attached sheet index.
9. Addenda (numbers? To ?, inclusive).
10. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid (pages ___ to ___, inclusive).
11. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Change Orders

B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

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

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

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

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10.02 *Assignment of Contract*

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

10.03 *Successors and Assigns*

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

10.04 *Severability*

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

10.05 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

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

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

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

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

10.06 *Other Provisions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all

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modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

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

OWNER:	CONTRACTOR:
Lebanon Water Works Company, Inc.	
By:	By:
Title: President	Title:
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest:	Attest:
Title:	Title:
Address for giving notices:	Address for giving notices:
120 South Proctor Knott Avenue	
Lebanon, KY 40033	
	License No.: _____ *(where applicable)*
(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)	*NOTE TO USER: Use in those states or other jurisdictions where applicable or required.*

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NOTICE TO PROCEED

Owner:	Lebanon Water Works, Inc.	Owner's Contract No.:	12
Contractor:		Contractor's Project No.:	
Engineer:	Kentucky Engineering Group, PLLC	Engineer's Project No.:	25006
Project:	2024 WTP & System Improvements	Contract Name:	Water Treatment Plant Improvements
		Effective Date of Contract:	

TO CONTRACTOR:

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

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, the date of Substantial Completion is _____, and the date of readiness for final payment is _____ ***or*** the number of days to achieve Substantial Completion is 510, and the number of days to achieve readiness for final payment is 540.

Before starting any Work at the Site, Contractor must comply with the following:
[Note any access limitations, security procedures, or other restrictions]

Call in for location of all existing utilities in work area.

Owner**:** Lebanon Water Works Company, Inc.

Authorized Signature

By: _____

Title: President

Date Issued: _____

Copy: Engineer

SECTION 00600

INSURANCE CERTIFICATE

Certificate of Insurance shall be provided in accordance with:

OWNER'S MINIMUM INSURANCE REQUIREMENTS

The Contractor at its expense shall procure and shall maintain the insurance required in this Contract and to be provided by the Contractor. The Contractor shall require each subcontractor to procure and maintain the insurance required by this Contract and to be provided by subcontractors. At a minimum, the following insurance
Limits shall be procured:

General Liability – Commercial General Liability
Limits of Insurance - $2,000,000 general aggregate
$2,000,000 products & completed operations aggregate
$1,000,000 personal & advertising
$1,000,000 each occurrence

Automobile Liability – All Owned, Non-owned & Hired vehicles
Limits of Liability - $1,000,000 per accident

Excess or Umbrella Liability
Limits of Liability - $2,000,000

Workmen's Compensation – Statutory Coverage in each state of operations or "all states" coverage
Limits of Liability - $100,000 each accident bodily injury
$500,000 policy limit bodily injury by disease
$100,000 each employee bodily injury by disease

Description of Operations
Lebanon Water Works Company, Inc. and Kentucky Engineering Group, PLLC must be added to the Commercial General Liability policy as an additional insured by Standard Endorsements CG 2010(11-85) and CG 2037 or their equivalents.

All policies, except workers compensation, shall include a waiver of subrogation.

Certificate Holder
Must list: Lebanon Water Works Company, Inc.
120 South Proctor Knott Avenue
Lebanon, Kentucky 40033

Cancellation
Thirty (30) days prior written notice is required.

Builders Risk/Installation Floater
May be required in an amount equal to the contract. If above ground structures are involved in the Contract, this is required.

END OF SECTION

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PERFORMANCE BOND

CONTRACTOR *(name and address)*:

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

OWNER *(name and address)*:
Lebanon Water Works Company, Inc.
120 South Proctor Knott Avenue
Lebanon, Kentucky 40033

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*: 2024 WTP & System Improvements - Contract 12 - Water Treatment Plant Improvements

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

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

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated

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obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

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

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

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

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

14. Definitions

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

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

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

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

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

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

16. Modifications to this Bond are as follows:

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PAYMENT BOND

CONTRACTOR *(name and address)*:

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

OWNER *(name and address)*
Lebanon Water Works Company, Inc.
120 South Proctor Knott Avenue
Lebanon, Kentucky 40033

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description *(name and location)*: 2024 WTP & System Improvements - Contract 12 - Water Treatment Plant Improvements

BOND

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

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

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

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

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

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

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

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

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

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

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

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

   5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to 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 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

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

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

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

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract

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or to related subcontracts, purchase orders, and other obligations.

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

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

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

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

16. **Definitions**

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

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

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

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

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

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

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

18. Modifications to this Bond are as follows:

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Contractor's Application for Payment No.

	Application Period:	Application Date:
To (Owner): Lebanon Water Works Company, Inc.	From (Contractor):	Via (Engineer): Kentucky Engineering Group, PLLC
Project: 2024 WTP & System Improvements	Contract: Contract 12 -Water Treatment Plant Improvements	
Owner's Contract No.: 12	Contractor's Project No.:	Engineer's Project No.: 25006

Application For Payment

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

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

Contractor's Certification

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

Contractor Signature

By:	Date:

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

is recommended by: _____ _____
Kentucky Engineering Group, PLLC (Date)

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

is approved by: _____ _____
Lebanon Water Works Company, Inc. (Date)

Approved by: _____ _____
(Date)

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Progress Estimate - Lump Sum Work

Contractor's Application

For (Contract): Contract 12 -Water Treatment Plant Improvements	Application Number:
Application Period:	Application Date:

A		B	C	D	E	F		G
Specification Section No.	Description	Scheduled Value ($)	Work Completed: From Previous Application (C+D)	Work Completed: This Period	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F / B)	Balance to Finish (B - F)
	Totals							

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Progress Estimate - Unit Price Work

Contractor's Application

For (Contract): Contract 12 -Water Treatment Plant Improvements	Application Number:
Application Period:	Application Date:

A					B	C	D	E	F		
Item		Contract Information									
Bid Item No.	Description	Item Quantity	Units	Unit Price	Total Value of Item ($)	Estimated Quantity Installed	Value of Work Installed to Date	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F / B)	Balance to Finish (B - F)
	Totals										

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Stored Material Summary

Contractor's Application

For (Contract): Contract 12 -Water Treatment Plant Improvements								Application Number:			
Application Period:								Application Date:			
A		B	C		D		E		F		G
Bid Item No.	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Storage Location	Description of Materials or Equipment Stored	Stored Previously		Amount Stored this Month ($)	Subtotal Amount Completed and Stored to Date (D + E)	Incorporated in Work		Materials Remaining in Storage ($) (D + E - F)
					Date Placed into Storage (Month/Year)	Amount ($)			Date (Month/ Year)	Amount ($)	
				Totals							

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EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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1801 Alexander Bell Drive, Reston, VA 20191-4400
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www.asce.org

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Change Order No. _____

Date of Issuance:		Effective Date:	
Owner:	Lebanon Water Works Company, Inc.	Owner's Contract No.:	12
Contractor:		Contractor's Project No.:	
Engineer:	Kentucky Engineering Group, PLLC	Engineer's Project No.:	25006
Project:	2024 WTP & System Improvements	Contract Name:	Water Treatment Plant Improvements

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

Description:

Attachments: *[List documents supporting change]*

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

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer (if required)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title _____	Title _____
Date: _____	Date _____	Date _____

Approved by Funding Agency (if applicable)

By: _____ Date:

Title: _____

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	Lebanon Water Works Company, Inc.	Owner's Contract No.:	12
Contractor:		Contractor's Project No.:	
Engineer:	Kentucky Engineering Group, PLLC	Engineer's Project No.:	25006
Project:	2024 WTP & System Improvements	Contract Name:	Water Treatment Plant Improvements

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

☐ All Work ☐ The following specified portions of the Work:

Date of Substantial Completion

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

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

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

Amendments to Owner's responsibilities: ☐ None ☐ As follows

Amendments to Contractor's responsibilities: ☐ None ☐ As follows:

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

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

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

CERTIFICATE OF OWNER'S ATTORNEY AND AGENCY CONCURRENCE

CERTFICATE OF OWNER'S ATTORNEY

PROJECT NAME: 2024 WTP & System Improvements

CONTRACTOR NAME:

I, the undersigned,_____, the duly authorized and acting legal representative of _____, do hereby certify as follows: I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Name Date

AGENCY CONCURRENCE
As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

Agency Representative Date

Name

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

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

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

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

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

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

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

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

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision

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regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

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

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

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

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

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

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

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

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

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

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

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

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

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

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

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

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

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

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

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

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

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

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

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

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

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and

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submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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

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

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

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

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

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

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

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

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the

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result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

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

C. *Day*:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*:

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

a. does not conform to the Contract Documents; or

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

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

E. *Furnish, Install, Perform, Provide*:

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

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

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

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

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

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

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

2.02 *Copies of Documents*

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

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

2.03 *Before Starting Construction*

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

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

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

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

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

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

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

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

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

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

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B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

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

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

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

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

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

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

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

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3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

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

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

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

B. *Resolving Discrepancies*:

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

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

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

3.04 *Requirements of the Contract Documents*

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

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract

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Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

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

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

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

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

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

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

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

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requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

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

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

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

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

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

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

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

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

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility

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that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

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

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

G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

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

5.01 *Availability of Lands*

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

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

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

5.02 *Use of Site and Other Areas*

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

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

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise;

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

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

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

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

5.03 *Subsurface and Physical Conditions*

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

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and

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procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

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

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

5.04 *Differing Subsurface or Physical Conditions*

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

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

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

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

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

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or

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decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

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

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

c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

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

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

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

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

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

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

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

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

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

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

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

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

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

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

E. *Possible Price and Times Adjustments*:

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

a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

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

c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

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

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

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

5.06 *Hazardous Environmental Conditions at Site*

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

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

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

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

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

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

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

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

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required

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by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

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

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

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

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

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Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

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

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

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

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

6.02 *Insurance—General Provisions*

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

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or

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authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

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

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

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

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6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).

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

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

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

a. Such insurance shall be maintained for three years after final payment.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

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

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

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

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

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

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4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

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

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

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

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available

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under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
6. extend to cover damage or loss to insured property while in transit.
7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
8. allow for the waiver of the insurer's subrogation rights, as set forth below.
9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
10. not include a co-insurance clause.
11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
12. include performance/hot testing and start-up.
13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

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

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provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of

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recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

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

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

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

7.02 *Labor; Working Hours*

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

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

7.03 *Services, Materials, and Equipment*

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

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

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

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

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

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

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

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

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

4) it is not objectionable to Owner.

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

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

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

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

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

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

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

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a. shall certify that the proposed substitute item will:

1) perform adequately the functions and achieve the results called for by the general design,

2) be similar in substance to that specified, and

3) be suited to the same use as that specified.

b. will state:

1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from that specified, and

2) available engineering, sales, maintenance, repair, and replacement services.

d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

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

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

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

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F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

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

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

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

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

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

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

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

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J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

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

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

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

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

7.07 *Patent Fees and Royalties*

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

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

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

7.08 *Permits*

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

7.09 *Taxes*

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

7.10 *Laws and Regulations*

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

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

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

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7.11 *Record Documents*

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

7.12 *Safety and Protection*

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

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

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

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

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

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

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of

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Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

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

7.13 *Safety Representative*

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

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

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

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

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

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

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

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

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

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

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

2. *Samples*:

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

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

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

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

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

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

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

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

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

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

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

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

E. *Resubmittal Procedures*:

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

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

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

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

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

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

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

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

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

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

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

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any

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limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner

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may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor

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must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

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

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

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9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

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

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

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9.12 *Safety Programs*

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

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

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

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10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

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

10.06 *Determinations for Unit Price Work*

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

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

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

10.08 *Limitations on Engineer's Authority and Responsibilities*

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

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

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

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

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

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10.09 *Compliance with Safety Program*

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

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

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

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

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change

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involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

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

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and

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11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole,

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approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

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

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ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

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

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction,

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the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

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

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

13.01 *Cost of the Work*

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

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

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3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

    g. The cost of utilities, fuel, and sanitary facilities at the Site.

    h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

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

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

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C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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

14.01 *Access to Work*

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

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14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

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

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

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C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

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

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

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1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

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

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

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

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for

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Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work, or

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

   d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

   e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

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D. *Payment Becomes Due*:

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

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

   a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

   b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

   c. Contractor has failed to provide and maintain required bonds or insurance;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

   e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

   f. the Work is defective, requiring correction or replacement;

   g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   h. the Contract Price has been reduced by Change Orders;

   i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

   j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

   k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

   l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction

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imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

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

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor

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may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

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inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all disputes that Contractor believes are unsettled; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer

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(less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

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

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;

2. correct such defective Work;

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with

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respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs,

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

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the

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

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

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

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of

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them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Headings*

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

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SUPPLEMENTAL GENERAL CONDITIONS

FOR

CLEAN WATER STATE REVOLVING FUND

DRINKING WATER STATE REVOLVING FUND

(Drinking Water and Wastewater)

Project Name:

2024 WTP & System Improvements
Water Treatment Plant Improvements

Project Number: F24-001S

The attached instructions and regulations as listed below shall be incorporated into the Specifications and comprise Special Conditions.

	Attachment No.
SRF Special Provisions	**1**
KRS Chapter 45A Kentucky Model Procurement Code	**2**
Equal Employment Opportunity (EEO) Documents:	
Notice of Requirement for Affirmative Action	**3**
Construction Contract Specifications	**4**
EEO Goals for Region 4 Economic Areas	**5**
Check List of EEO Documentation for Bidders	**6**
Employer Information Report EEO-1 (SF 100)	**7**
Labor Standards Provisions for Federally Assisted Construction	**8**
Certifications:	
Debarment, Suspension and Other Responsibility Matters	**9**
Anti-lobbying	**10**
Disadvantaged Business Enterprise (DBE) Program	**11**
Bonds and Insurance	**12**
Storm Water General Permit	**13**
Davis-Bacon Wage Rate Requirements	**14**
American Iron and Steel Requirement	**15**

Attachment Number 1

SRF SPECIAL PROVISIONS

(a) Line crossings of all roads and streets shall be done in accordance with the Kentucky Transportation Cabinet requirements as may be set forth in the Special Conditions.

(b) Construction is to be carried out so as to prevent by-passing of flows during construction unless a schedule has been approved by the State or EPA, whichever is applicable. Siltation and soil erosion must be minimized during construction. All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The permit can be found at this webpage.

If you have any questions regarding the completion of this form call the Surface Water Permits Branch at (502) 564-3410.

(c) Restore disturbed areas to original or better condition.

(d) Use of Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either DOW or EPA. Use of all such chemicals and disposal of residues shall be in conformance with instructions on the manufacturer's label.

(e) The construction of the project, including the letting of contracts in connection therewith, shall conform to the applicable requirements of state, territorial, and local laws and ordinances to the extent that such requirements do not conflict with Federal laws and this subchapter.

(f) The owner shall provide and maintain competent and adequate supervision and inspection.

(g) The Kentucky Infrastructure Authority and Kentucky Division of Water shall have access to the site and the project work at all times.

(h) In the event Archaeological materials (arrowheads, stone tools, stone axes, prehistoric and historic pottery, bottles, foundations, Civil War artifacts, and other types of artifacts) are uncovered during the construction of this project, work is to immediately cease at the location and the Kentucky Heritage Council shall be contacted. The telephone number is (502) 564-7005. Construction shall commence at this location until a written release is received from the Kentucky Heritage Council. Failure to report a find could result in legal action.

(i) This procurement will be subject to DOW Procurement Guidance including the Davis-Bacon Act.

(j) Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

(k) No wastewater bypassing will occur during construction unless a schedule has been approved by the Kentucky Division of Water.

(l) Provisions shall be made to obtain a Section 404 permit from the Corps of Engineers, if required

(m) Change orders to the construction contract (if required) must be negotiated pursuant to DOW/KIA Procurement Guidance for Construction and Equipment Contracts.

KRS CHAPTER 45A
KENTUCKY MODEL PROCUREMENT CODE

45A.075 Methods of awarding state contracts.
Except as otherwise authorized by law, all state contracts shall be awarded by:
(1) Competitive sealed bidding, pursuant to KRS 45A.080; or
(2) Competitive negotiation, pursuant to KRS 45A.085 and 45A.090 or 45A.180; or
(3) Noncompetitive negotiation, pursuant to KRS 45A.095; or
(4) Small purchase procedures, pursuant to KRS 45A.100.
Effective: June 24, 2003
History: Amended 2003 Ky. Acts ch. 98, sec. 4, effective June 24, 2003. -- Created 1978 Ky. Acts ch. 110, sec. 16, effective January 1, 1979.

45A.080 Competitive sealed bidding.
(1) Contracts exceeding the amount provided by KRS 45A.100 shall be awarded by competitive sealed bidding, which may include the use of a reverse auction, unless it is determined in writing that this method is not practicable. Factors to be considered in determining whether competitive sealed bidding is not practicable shall include:
(a) Whether specifications can be prepared that permit award on the basis of best value; and
(b) The available sources, the time and place of performance, and other relevant circumstances as are appropriate for the use of competitive sealed bidding.
(2) The invitation for bids shall state that awards shall be made on the basis of best value. In any contract which is awarded under an invitation to bid which requires delivery by a specified date and imposes a penalty for late delivery, if the delivery is late, the contractor shall be given the opportunity to present evidence that the cause of the delay was beyond his control. If it is the opinion of the purchasing officer that there is sufficient justification for delayed delivery, the purchasing officer may adjust or waive any penalty that is provided for in the contract.
(3) Adequate public notice of the invitation for bids and any reverse auction shall be given a sufficient time prior to the date set forth for the opening of bids or beginning of the reverse auction. The notice may include posting on the Internet or publication in a newspaper or newspapers of general circulation in the state as determined by the secretary of the Finance and Administration Cabinet not less than seven (7) days before the date set for the opening of the bids and any reverse auction. The provisions of this subsection shall also apply to price contracts and purchase contracts of state institutions of higher education.
(4) Bids shall be opened publicly or entered through a reverse auction at the time and place designated in the invitation for bids. At the time the bids are opened, or the reverse auction has ended, the purchasing agency shall announce the agency's engineer's estimate, if applicable, and make it a part of the agency records pertaining to the letting of any contract for which bids were received. Each written or reverse auction bid, together with the name of the bidder and the agency's engineer's estimate, shall be recorded and be open to public inspection. Electronic bid opening and posting of the required information for public viewing shall satisfy the requirements of this subsection.
(5) The contract shall be awarded by written notice to the responsive and responsible bidder whose bid offers the best value.
(6) Correction or withdrawal of written or reverse auction bids shall be allowed only to the extent permitted by regulations issued by the secretary.
Effective: July 15, 2010
History: Amended 2010 Ky. Acts ch. 63, sec. 3, effective July 15, 2010. -- Amended 2000 Ky. Acts ch. 509, sec. 1, effective July 14, 2000. -- Amended 1998 Ky. Acts ch. 120, sec. 10, effective July 15, 1998. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 27, effective May 30, 1997. -- Amended 1996 Ky. Acts ch. 60, sec. 2, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 278, sec. 1, effective July 15, 1994. -- Amended 1982 Ky. Acts ch. 282, sec. 1, effective July 15, 1982. -- Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 1, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 17, effective January 1, 1979.

45A.085 Competitive negotiation.
(1) When, under administrative regulations promulgated by the secretary or under KRS 45A.180, the purchasing officer determines in writing that the use of competitive sealed bidding is not practicable, and except as provided in KRS 45A.095 and 45A.100, a contract may be awarded by competitive negotiation, which may include the use of a reverse auction.
(2) Adequate public notice of the request for proposals and any reverse auction shall be given in the same manner and circumstances as provided in KRS 45A.080(3).
(3) Contracts other than contracts for projects utilizing an alternative project delivery method under KRS 45A.180 may be competitively negotiated when it is determined in writing by the purchasing officer that the bids received by competitive sealed bidding either are unreasonable as to all or part of the requirements, or were not independently reached in open competition, and for which each competitive bidder has been notified of the intention to negotiate and is given reasonable opportunity to negotiate.
(4) Contracts for projects utilizing an alternative project delivery method shall be processed in accordance with KRS 45A.180.
(5) The request for proposals shall indicate the relative importance of price and other evaluation factors, and any reverse auction procedures.
(6) Award shall be made to the responsible and responsive offeror whose proposal is determined in writing to be the most advantageous to the Commonwealth, taking into consideration price and the evaluation factors set forth in the request for proposals and the reciprocal preference for resident bidders required under KRS 45A.494.
(7) Written or oral discussions shall be conducted with all responsible offerors who submit proposals determined in writing to be reasonably susceptible of being selected for award. Discussions shall not disclose any information derived from proposals submitted by competing offerors. Discussions need not be conducted:
(a) With respect to prices, where the prices are fixed by law, reverse auction, or administrative regulation, except that consideration shall be given to competitive terms and conditions;
(b) Where time of delivery or performance will not permit discussions; or
(c) Where it can be clearly demonstrated and documented from the existence of adequate competition or prior experience with the particular supply, service, or construction item, that acceptance of an initial offer without discussion would result in fair and reasonable best value procurement, and the request for proposals notifies all offerors of the possibility that award may be made on the basis of the initial offers.
Effective: July 15, 2010
History: Amended 2010 Ky. Acts ch. 63, sec. 4, effective July 15, 2010; and ch. 162, sec. 8, effective July 15, 2010. -- Amended 2003 Ky. Acts ch. 98, sec. 5, effective June 24, 2003. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 28, effective May 30, 1997. -- Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 2, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 18, effective January 1, 1979.

45A.090 Negotiation after competitive sealed bidding when all bids exceed available funds.
(1) In the event that all bids submitted pursuant to competitive sealed bidding under KRS 45A.080 result in bid prices in excess of the funds available for the purchase, and the chief purchasing officer determines in writing:
(a) That there are no additional funds available from any source so as to permit an award to the responsive and responsible bidder whose bid offers the best value; and
(b) The best interest of the state will not permit the delay attendant to a resolicitation under revised specifications, or for revised quantities, under competitive sealed bidding as provided in KRS 45A.080, then a negotiated award may be made as set forth in subsections (2) or (3) of this section.
(2) Where there is more than one (1) bidder, competitive negotiations pursuant to KRS 45A.085(3) shall be conducted with the three (3) (two (2) if there are only two (2)) bidders determined in writing to be the most responsive and responsible bidders, based on criteria contained in the bid invitation and the reciprocal preference for resident bidders under KRS 45A.494. Such competitive negotiations shall be conducted under the following restrictions:
(a) If discussions pertaining to the revision of the specifications or quantities are held with any potential offeror, all other potential offerors shall be afforded an opportunity to take part in such discussions; and

(b) A request for proposals, based upon revised specifications or quantities, shall be issued as promptly as possible, shall provide for an expeditious response to the revised requirements, and shall be awarded upon the basis of best value.
(3) Where, after competitive sealed bidding, it is determined in writing that there is only one (1) responsive and responsible bidder, a noncompetitive negotiated award may be made with such bidder in accordance with KRS 45A.095.
Effective: July 15, 2010
History: Amended 2010 Ky. Acts ch. 162, sec. 9, effective July 15, 2010. -- Amended 2003 Ky. Acts ch. 98, sec. 6, effective June 24, 2003. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 29, effective May 30, 1997. -- Created 1978 Ky. Acts ch. 110, sec. 19, effective January 1, 1979.

45A.095 Noncompetitive negotiation.
(1) A contract may be made by noncompetitive negotiation only for sole source purchases, or when competition is not feasible, as determined by the purchasing officer in writing prior to award, under administrative regulations promulgated by the secretary of the Finance and Administration Cabinet or the governing boards of universities operating under KRS Chapter 164A, or when emergency conditions exist. Sole source is a situation in which there is only one (1) known capable supplier of a commodity or service, occasioned by the unique nature of the requirement, the supplier, or market conditions. Insofar as it is practical, no less than three (3) suppliers shall be solicited to submit written or oral quotations whenever it is determined that competitive sealed bidding is not feasible. Award shall be made to the supplier offering the best value. The names of the suppliers submitting quotations and the date and amount of each quotation shall be placed in the procurement file and maintained as a public record. Competitive bids may not be required:
(a) For contractual services where no competition exists, such as telephone service, electrical energy, and other public utility services;
(b) Where rates are fixed by law or ordinance;
(c) For library books;
(d) For commercial items that are purchased for resale;
(e) For interests in real property;
(f) For visiting speakers, professors, expert witnesses, and performing artists;
(g) For personal service contracts executed pursuant to KRS 45A.690 to 45A.725; and
(h) For agricultural products in accordance with KRS 45A.645.
(2) The chief procurement officer, the head of a using agency, or a person authorized in writing as the designee of either officer may make or authorize others to make emergency procurements when an emergency condition exists.
(3) An emergency condition is a situation which creates a threat or impending threat to public health, welfare, or safety such as may arise by reason of fires, floods, tornadoes, other natural or man-caused disasters, epidemics, riots, enemy attack, sabotage, explosion, power failure, energy shortages, transportation emergencies, equipment failures, state or federal legislative mandates, or similar events. The existence of the emergency condition creates an immediate and serious need for services, construction, or items of tangible personal property that cannot be met through normal procurement methods and the lack of which would seriously threaten the functioning of government, the preservation or protection of property, or the health or safety of any person.
(4) The Finance and Administration Cabinet may negotiate directly for the purchase of contractual services, supplies, materials, or equipment in bona fide emergencies regardless of estimated costs. The existence of the emergency shall be fully explained, in writing, by the head of the agency for which the purchase is to be made. The explanation shall be approved by the secretary of the Finance and Administration Cabinet and shall include the name of the vendor receiving the contract along with any other price quotations and a written determination for selection of the vendor receiving the contract. This information shall be filed with the record of all such purchases and made available to the public. Where practical, standard specifications shall be followed in making emergency purchases. In any event, every effort should be made to effect a competitively established price for purchases made by the state.
Effective: July 15, 2002

History: Amended 2002 Ky. Acts ch. 344, sec. 9, effective July 15, 2002. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 30, effective May 30, 1997. -- Amended 1990 Ky. Acts ch. 496, sec. 4, effective July 13, 1990. -- Created 1978 Ky. Acts ch. 110, sec. 20, effective January 1, 1979

45A.100 Small purchases by state governmental bodies.

(1) Procurements may be made in accordance with small purchase administrative regulations promulgated by the secretary of the Finance and Administration Cabinet, pursuant to KRS Chapter 13A, as follows:

(a) Up to ten thousand dollars ($10,000) per project for construction and one thousand dollars ($1,000) for purchases by any state governmental body, except for those state administrative bodies specified in paragraph (b) of this subsection; and

(b) Up to forty thousand dollars ($40,000) per project for construction or purchases by the Finance and Administration Cabinet, state institutions of higher education, and the legislative branch of government.

(2) Procurement requirements shall not be artificially divided so as to constitute a small purchase under this section. Reverse auctions may be used for small purchase procurements. At least every two (2) years, the secretary shall review the prevailing costs of labor and materials and may make recommendations to the next regular session of the General Assembly for the revision of the then current maximum small purchase amount as justified by intervening changes in the cost of labor and materials.

(3) The secretary of the Finance and Administration Cabinet may grant to any state agency with a justifiable need a delegation of small purchasing authority which exceeds the agency's small purchase limit provided in subsection (1) of this section. Delegations of small purchasing authority shall be granted or revoked by the secretary of the Finance and Administration Cabinet, in accordance with administrative regulations promulgated by the cabinet pursuant to KRS Chapter 13A. These administrative regulations shall establish, at a minimum, the criteria for granting and revoking delegations of small purchasing authority, including the requesting agency's past compliance with purchasing regulations, the level of training of the agency's purchasing staff, and the extent to which the agency utilizes the Kentucky Automated Purchasing System. The administrative regulations may permit the secretary of the Finance and Administration Cabinet to delegate small purchase procurements up to the maximum amount specified in subsection (1)(b) of this section.

Effective: July 15, 2010

History: Amended 2010 Ky. Acts ch. 63, sec. 5, effective July 15, 2010. -- Amended 2002 Ky. Acts ch. 320, sec. 2, effective July 15, 2002. -- Amended 2000 Ky. Acts ch. 225, sec. 1, effective July 14, 2000. -- Amended 1996 Ky. Acts ch. 60, sec. 1, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 323, sec. 1, effective July 15, 1994. -- Amended 1990 Ky. Acts ch. 496, sec. 5, effective July 13, 1990. -- Amended 1986 Ky. Acts ch. 384, sec. 1, effective July 15, 1986. -- Amended 1984 Ky. Acts ch. 384, sec. 1, effective July 13, 1984. -- Amended 1982 Ky. Acts ch. 282, sec. 2, effective July 15, 1982. -- Amended 1980 Ky. Acts ch. 242, sec. 1, effective July 15, 1980; and ch. 250, sec. 19, effective April 9, 1980. -- Created 1978 Ky. Acts ch. 110, sec. 21, effective January 1, 1979.

Attachment Number 3

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

The following excerpts are from 45 FR 65984 (October 3, 1980):

The minority and female goals apply to Federal and federally assisted construction contractors and subcontractors which have covered contracts. The goals are expressed as a percentage of the total hours worked by such a covered or subcontractor's entire onsite construction workforce, which is working on any construction site within a relevant area. The goal applies to each construction craft and trade in the contractor's entire workforce in the relevant area including those employees working on private non-federally involved projects.

Until further notice, the following goals for minority utilization in each construction craft and trade shall be included in all Federal or federally assisted construction contracts and subcontracts in excess of $10,000 to be performed in the respective geographic area. The goals are applicable to each nonexempt contractor's total onsite construction workforce, regardless of whether or not part of that workforce is performing work on a Federal, federally assisted or non-federally related project, contract or subcontract.

Construction contractors which are participating in an approved Hometown Plan (see 41 CFR 60-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply as follows:

Goals for female participation in each trade.....6.9%
Goals for minority participation in each trade.....Insert goals for each year
(see Attachment Number 5)

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area.

The following excerpts are from 45 FR 65977 (October 3, 1980):

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

As used in this Notice, and in the contract resulting from this solicitation, the covered area is (insert description of the geographical areas where the contract is to be performed giving the state, country, and city, if any).

Attachment Number 4

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

EEO Specifications

Following is the standard language, which must be incorporated into all solicitations for offers and bids on all Federal and Federally assisted construction contracts or subcontracts in excess of $10,000 to be performed in designated geographical areas:

1. As used in these specifications:

   (a) Covered Area means the geographical area described in the solicitation from which this contract resulted.

   (b) Director means Director, Office of Federal Contract Compliance Program, United States Department of Labor, or any person to whom the Director delegates authority;

   (c) Employer identification number means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

   (d) Minority includes:

      (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take a good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7-a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensively as the following:

    a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

    b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations responses.

    c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the contractor may have taken.

    d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligation.

    e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources complied under 7-b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, lay-off, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foreman, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative actions obligations (7 a through p). The efforts of a contractor association, joint contractor-union, contractor-community, of other similar group of which the contractor is a member and participant may be asserted as fulfilling any one or more of its obligations under 7 a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example: even though the Contractor has achieved its goal for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables for affirmative action standards to discriminate against any person because of race, color, religion, sex or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

EEO GOALS FOR ECONOMIC AREAS IN REGION 4
SOURCE: APPENDIX B-80 IN 45 FR 65984 (OCTOBER 3, 1980)

Kentucky:

053 Knoxville, TN
SMSA Counties:
3840 Knoxville, TN 6.6
TN Anderson; TN Blount; TN Knox; TN Union.
Non-SMSA Counties 4.5
KY Bell; KY Harlan; KY Knox; KY Laurel; KY McCreary; KY Wayne; KY Whitley; TN Campbell; TN Claiborne; TN Cocke; TN Cumberland; TN Fentress; TN Grainger, TN Hamblen; TN Jefferson; TN Loudon; TN Morgan; TN Roane; TN Scott; TN Sevier.

054 Nashville, TN:
SMSA Counties:
1660 Clarksville - Hopkinsville, TN - KY 18.2
KY Christian; TN Montgomery.
5360 Nashville - Davidson, TN 15.8
TN Cheatham, TN Davidson; TN Dickson; TN Robertson; TN Rutherford; TN Sumner; TN Williamson; TN Wilson.
Non-SMSA Counties 12.0
KY Allen; KY Barren; KY Butler; KY Clinton; KY Cumberland; KY Edmonson; KY Logan; KY Metcalfe; KY Monroe; KY Simpson; KY Todd; KY Trigg; KY Warren; TN Bedford; TN Cannon; TN Clay; TN Coffee; TN DeKalb; TN Franklin; TN Giles; TN Hickman; TN Houston; TN Humphreys; TN Jackson; TN Lawrence; TN Lewis; TN Macon; TN Marshall; TN Maury; TN Moore; TN Overton; TN Perry; TN Pickett; TN Putnam; TN Smith; TN Stewart; TN Trousdale; TN Van Buren; TN Warren; TN Wayne; TN White.

056 Paducah, KY:
Non-SMSA Counties 5.2
IL Hardin; IL Massac; IL Pope; KY Ballard; KY Caldwell; KY Calloway. KY Carlisle; KY Crittenden; KY Fulton; KY Graves; KY Hickman; KY Livingston; KY Lyon. KY McCracken; KY Marshall.

057 Louisville, KY:
SMSA Counties:
4520 Louisville, KY-IN 11.2
IN Clark; IN Floyd; KY Bullitt; KY Jefferson; KY Oldham.
Non-SMSA Counties 9.6
IN Crawford; IN Harrison; IN Jefferson; IN Orange; IN Scott; IN Washington; KY Breckinridge; KY Grayson; KY Hardin; KY Hart; KY Henry; KY Larue; KY Marion; KY Meade; KY Nelson; KY Shelby; KY Spencer; KY Trimble; KY Washington.

058 Lexington, KY
SMSA Counties
4280 Lexington-Fayette, KY 10.8
KY Bourbon; KY Clark; KY Fayette; KY Jessamine; KY Scott; KY Woodford.
Non-SMSA Counties 7.0
KY Adair KY Anderson; KY Bath; KY Boyle; KY Breathitt; KY Casey; KY Clay; KY Estill; KY Franklin; KY Garrard; KY Green; KY Harrison; KY Jackson; KY Knott; KY Lee; KY Leslie; KY Letcher; KY Lincoln; KY Madison; KY Magoffin; KY Menifee; KY Mercer; KY Montgomery; KY Morgan. KY Nicholas; KY Owsley; KY Perry; KY Powell; KY Pulaski; KY Rockcastle; KY Russell; KY Taylor; KY Wolfe.
059 Huntington, WV:
SMSA Counties:
3400 Huntington - Ashland, WV-KY-OH 2.9
KY Boyd; KY Greenup; OH Lawrence; WV Cabell; WV Wayne.
Non-SMSA Counties 2.5
KY Carter; KY Elliott; KY Floyd; KY Johnson; KY Lawrence; KY Martin; KY Pike; KY Rowan; OH Gallia; WV Lincoln; WV Logan; WV Mason; WV Mingo.
067 Cincinnati, OH:
SMSA Counties:
1640 Cincinnati, OH-KY-IN 11.0
IN Dearborn; KY Boone; KY Campbell; KY Kenton; OH Clermont; OH Hamilton; OH Warren.
3200 Hamilton - Middletown, OH 5.0
OH Butler.
Non-SMSA Counties 9.2
IN Franklin; IN Ohio; IN Ripley; IN Switzerland; KY Bracken; KY Carroll; KY Fleming; KY Gallatin; KY Grant; KY Lewis; KY Mason; KY Owen; KY Pendleton; KY Robertson; OH Adams; OH Brown; OH Clinton; OH Highland.
080 Evansville, IN:
SMSA Counties
2440 Evansville, IN-KY 4.8
IN Gibson; IN Posey; IN Vanderburgh; IN Warrick; KY Henderson.
5990 Owensboro, KY 4.7
KY Daviess.
Non-SMSA Counties 3.5
IL Edwards; IL Gallatin; IL Hamilton; IL Lawrence; IL Saline; IL Wabash; IL White; IN Dubois; IN Knox; IN Perry; IN Pike; IN Spencer; KY Hancock; KY Hopkins; KY McLean; KY Muhlenberg; KY Ohio; KY Union; KY Webster.

Attachment Number 6

CHECK LIST OF EEO DOCUMENTATION FOR BIDDERS ON GRANT/LOAN CONSTRUCTION (EXECUTIVE ORDER 11246 AS AMENDED)

The low, responsive responsible bidder must forward the following items, in duplicate, to the owner no later than ten (10) days after bid opening. The owner shall have one (1) copy available for inspection by the Office of Federal Contracts Compliance (OFCC) within 14 days after the bid opening. More information can be found on the OFCC webpage.

1. Project Number. Project Location. Type of Construction.

2. Proof of registration with the Joint Reporting Commission. (See Attachment Number 7.)

3. Copy of Affirmative Action Plan of contractor. Indicate company official responsible for EEO.

4. List of current construction contracts, with dollar amount. List contracting Federal Agency, if applicable.

5. Statistics concerning company percent workforce, permanent and temporary, by sex, race, trade, handicapped, and age. 40 CFR Part 7.

6. List of employment sources for project in question. If union sources are utilized, indicate percentage of minority membership within the union crafts.

7. Anticipated employment needs for this project, by sex, race and trade, with estimate of minority participation in specific trades.

8. List of subcontractors (name, address and telephone) with dollar amount and duration of subcontract. Subcontractor contracts over $10,000 must submit items 1- 7. The following information must be provided for all supplier contracts regardless of contract size: name of company, contact person, address, telephone number, dollar value of the contract, and a list of the materials to be supplied to the prime contractor.

9. List of any subcontract work yet to be committed with estimate of dollar amount and duration of contract.

10. Contract Price. Duration of prime contract.

11. DBE Documents - See special instructions regarding use of Minority, and Women Owned, and Small Businesses.

Attachment Number 7

EMPLOYER INFORMATION REPORT EEO-1

Under the direction of the US Equal Employment Opportunity Commission, the Joint Reporting Committee is responsible for the full-length, multi-phase processing of employment statistics collected on the Employer Information Report EEO-1. This report, also termed Standard Form 100, details the sex and race/ethnic composition of an employer's work force by job category.

The Employer Information EEO-1 survey is conducted annually under the authority of Public Law 88-352, Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972. All employers with 15 or more employees are covered by Public Law 88-352 and are required to keep employment records as specified by Commission regulations. Based on the number of employees and federal contract activities, certain large employers are required to file an EEO-1 Report on an annual basis.

The EEO-1 Report must be filed by:

(A) All private employers who are: (1) subject to Title VII of the Civil Rights Act of 1964 (as amended by the Equal Employment Opportunity Act of 1972) with 100 or more employees EXCLUDING State and local governments, primary and secondary school systems, institutions of higher education, Indian tribes and tax-exempt private memberships clubs other than labor organizations; OR (2) subject to Title VII who have fewer than 100 employees if the company is owned or affiliated with another company, or there is centralized ownership, control or management (such as central control of personnel policies and labor relations) so that the group legally constitutes a single enterprise and the entire enterprise employs a total of 100 or more employees.

(B) All federal contractors (private employers), who: (1) are not exempt as provided for by 41 CFR 60-1.5, (2) have 50 or more employees, and (a) are prime contractors or first-tier subcontractors, and have a contract, subcontract, or purchase order amounting to $50,000 or more; or (b) serve as depository of Government funds in any amount, or (c) is a financial institution which is an issuing an paying agent for U.S. Savings Bonds and Notes.

Only those establishments located in the District of Columbia and the 50 states are required to submit the EEO-1 Report. No Reports should be filed for establishments in Puerto Rico, the Virgin Islands or other American Protectorates.

When filing for the EEO-1 Report for the first time, go to the U.S. Equal Employment Opportunity Commission webpage and select "First Time Filers". Fill out the electronic questionnaire to enter your company into Joint Reporting Committee (JRC) system. Once you have completed the registration process, you will be contacted on how to proceed with the EEO-1 Report. If you have previously registered with the JRC, follow their instructions to update your information.

LABOR STANDARDS PROVISIONS FOR FEDERALLY ASSISTED CONSTRUCTION

Labor standards provisions applicable to contracts covering federally financed and assisted construction (29 CFR 5.5, Contract Provisions and Related Matters) that apply to EPA State Revolving Fund loans are:

(a)(4)(iii) *Equal employment opportunity.* The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(a)(5) *Compliance with Copeland Act requirements.* The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

(a)(6) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5 (a)(1) through (10) and such other clauses as the U.S. Environmental Protection Agency may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(a)(7) *Contract termination: debarment.* A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(b) *Contractor Work Hours and Safety Standards Act.* The Administrator, EPA, shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by §5.5(a) or §4.6 of part 4 of this title. As used in this paragraph, the terms *laborers* and *mechanics* include watchmen and guards.

(b)(1) *Overtime requirements.* No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(b)(2) *Violation; liability for unpaid wages; liquidated damages.* In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for unliquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) *Withholding for unpaid wages and liquidated damages.* The U.S. Environmental Protection Agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime

contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in section §5.1, the Administrator of EPA shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Administrator of EPA shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the U.S. Environmental Protection Agency and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job. (Approved by the Office of Management and Budget under OMB control numbers 1215-0140 and 1215-0017.)

CERTIFICATIONS

Debarred Firms

All prime Construction Contractors shall certify that Subcontractors have not and will not be awarded to any firm that is currently on the EPA Master List of Debarred, Suspended and Voluntarily Excluded Persons in accordance with the provisions of 40 CFR 32.500(c). Debarment action is taken against a firm for noncompliance with Federal Law.

All bidders shall complete the attached certification (Attachment Number 9) and submit to the owner with the bid proposal.

Anti-lobbying Certification

All prime Construction Contractors must certify (Attachment Number 10) that no appropriated funds were or will be expended for the purpose of lobbying the Executive or Legislative Branches of the Federal Government or Federal Agency concerning this contract (contract in excess of $100,000). If the Contractor has made or agreed to make payment to influence any member of Congress in regard to award of this contract, a Disclosure Form must be completed and submitted to the owner with the bid proposal.

All prime Contractors must require all Subcontractors to submit the certification, which must also be submitted to the owner.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both.

_____

Typed Name & Title of Authorized Representative

_____

Signature of Authorized Representative Date

_____ I am unable to certify to the above statements. My explanation is attached.

Attachment Number 10

CERTIFICATION REGARDING LOBBYING
CERTIFICATION FOR CONTRACTS, GRANTS, LOANS, AND COOPERATIVE AGREEMENTS

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 an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

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

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients 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.

_____

Typed Name & Title of Authorized Representative

_____

Signature of Authorized Representative Date

_____ I am unable to certify to the above statements. My explanation is attached.

EPA DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

EPA's Disadvantaged Business Enterprise Program rule applies to contract procurement actions funded in part by EPA assistance agreements awarded after May 27, 2008. The rule is found at Federal regulation Title 40, Part 33. Specific responsibilities are highlighted below.

Loan recipient responsibilities:

- Include in each contract with a primary contractor the following term and condition:

  "The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract." (*Appendix A to Part 33—Term and Condition)*

- Employ the six Good Faith Efforts during prime contractor procurement (§33.301).

- Require the prime contractor to comply with the following prime contractor requirements of Title 40 Part 33:

  - To pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient (§33.302(a)).

  - To notify recipient in writing prior to any termination of a DBE subcontractor for convenience by the prime contractor (§33.302(b)).

  - To employ the six Good Faith Efforts described in §33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason (§33.302(c)).

  - To employ the six Good Faith Efforts described in §33.301 even if the prime contractor has achieved its fair share objectives under subpart D of Part 33 (§33.302(d)).

  - To provide EPA Form 6100-2 – *DBE Program Subcontractor Participation Form* to all DBE subcontractors (§33.302(e)). **NOTE: this requirement has been suspended.**

  - To submit EPA Forms 6100-3 – *DBE Program Subcontractor Performance Form* and 6100-4 *DBE Program Subcontractor Utilization Form* as part of the bid package or proposal (§33.302(f) and (g)). **NOTE: this requirement has been suspended.**

  - To employ the six Good Faith Efforts steps in paragraphs (a) through (f) of §33.301 while procuring any subcontracts (§33.302(i)).

- Conduct an Availability Analysis and negotiate fair share objectives with EPA (§33.401), or adopt the fair share objectives of the oversight state agency revolving loan fund for comparable infrastructure (§33.405(b)(3)).

- Maintain all records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its prime contractors', good faith efforts (§33.501(a)).

- Create and maintain a bidders list and require the prime contractor to create and maintain a bidders list (§33.501(b)). This list must include all firms that bid or quote on prime contracts, or bid or quote subcontracts, including both MBE/WBEs and non-MBE/WBEs. This list must be kept until the project period for the identified loan has ended. The following information must be obtained from all prime and subcontractors:

  (a) Entity's name with point of contact,
  (b) Entity's mailing address, telephone number, and email address,
  (c) The procurement on which the entity bid or quoted, and when, and,
  (d) Entity's status as an MBE/WBE or non-MBE/WBE.

Prime Contractor Responsibilities:

- Include in each contract with a subcontractor the following term and condition:

  "The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract." (*Appendix A to Part 33—Term and Condition)*

- Employ the six Good Faith Efforts during subcontractor procurement (§33.301).

- Pay subcontractors for satisfactory performance no more than 30 days from receipt of payment from the recipient (§33.302(a)).

- Notify recipient in writing prior to termination of a DBE subcontractor for convenience (§33.302(b)).

- Employ the six Good Faith Efforts described in §33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason. (§33.302(c)).

- Employ the six Good Faith Efforts described in §33.301 even if the fair share objectives have been achieved under subpart D of Part 33 (§33.302(d)).

- Provide EPA Forms 6100-2 – *DBE Program Subcontractor Participation Form* and 6100-3 – *DBE Program Subcontractor Performance Form* to each DBE subcontractor prior to opening of the subcontractor's bid or proposal (§33.302(e) and (f)). **NOTE: this requirement has been suspended.**

- Complete EPA Form 6100-4 – *DBE Program Subcontractor Utilization Form* (§33.302(g)). **NOTE: this requirement has been suspended.**

- Submit to recipient with the bid package or proposal the completed EPA Form 6100-4, plus an EPA Form 6100-3 for each DBE subcontractor used in the bid or proposal (§33.302(f) and (g)). **NOTE: this requirement has been suspended.**

- Maintain all records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its subcontractors', good faith efforts (§33.501(a)).

- Create and maintain a bidders list and require the subcontractor to create and maintain a bidders list (§33.501(b)). This list must include all firms that bid or quote on subcontracts, including both

MBE/WBEs and non-MBE/WBEs. This list must be kept until the project period for the identified loan has ended. The following information must be obtained from all subcontractors:

(a) Entity's name with point of contact,
(b) Entity's mailing address, telephone number, and email address,
(c) The procurement on which the entity bid or quoted, and when, and,
(d) Entity's status as an MBE/WBE or non-MBE/WBE.

Subcontractor Responsibilities:

- May submit EPA Form 6100-2 – *DBE Program Subcontractor Participation Form* directly to DOW Project Manager (§33.302(e)). **NOTE: this requirement has been suspended.**

- Must complete EPA Form 6100-3 – *DBE Program Subcontractor Performance Form* and submit it to the prime contractor soliciting services prior to the prime contractor opening bids or quotes. **NOTE: this requirement has been suspended.**

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION POLICY

PROJECT NAME: _____ **BID DATE:** _____

1. Name, address and telephone number of contact person on all DBE matters:

Prime Contractor's Name: _____
Contact Person: _____
Address: _____
Phone: _____
Cell Phone: _____
Email: _____
Total Contract Amount: _____

2. Total dollar amount/percent of contract of MBE participation: _____

3. Total dollar amount/percent of contract of WBE participation: _____

4. Are certifications* for each MBE/WBE/DBE subcontractor enclosed; if no, please explain: _____ ☐ Yes ☐ No

5. Are MBE/WBE/DBE subcontracts or letters of intent signed by both parties enclosed; if no, please explain: _____ ☐ Yes ☐ No

6. List of MBE Subcontractors:

Name: _____
Contact Person: _____
Address: _____
Phone: _____
Cell Phone: _____
Email: _____
Type of Contract: _____
Work to be Done: _____
Amount: _____

7. List of WBE Subcontractors:

Name: _____
Contact Person: _____
Address: _____
Phone: _____
Cell Phone: _____
Email: _____
Type of Contract: _____
Work to be Done: _____
Amount: _____

Attach Additional Sheets, If Necessary

*Self-certification: Self certification of MBE/WBE/DBE firms will NOT be accepted as a valid form of certification of MBE/WBE/DBE status.

8. Information and documentation concerning efforts taken to comply with EPA's "six good faith efforts"

(i). Ensure DBE construction firms or material suppliers are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities; including placing DBEs on solicitation lists and soliciting them whenever they are potential sources. A good source for a list of DBEs is the Kentucky Transportation's Certified DBE Directory webpage.

☐ The prime contractor certifies that a solicitation list of qualified DBE vendors was developed for current and future solicitations. *Submit a copy of the list as documentation*.

(ii). Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process; including, whenever possible, posting solicitation for bids or proposals for a sufficient amount of time as to receive a competitive bid or proposal pool.

☐ The prime contractor certifies that every opportunity was provided to a number of DBEs to encourage their participation in the competitive process and that an adequate amount of time was provided for response. Must do at least one of the below.

a. List each DBE construction firm or material supplier to which a solicitation was attempted. *Submit copies of letters, emails, faxes, telecommunication logs, certified mail receipts, returned envelopes, certified mail return receipts, etc. as documentation*.

Company name and phone number: _____
Area of work expertise: _____
Date of any follow-ups and person spoke to: _____

b. Advertisements, if applicable: List each publication in which an announcement or notification was placed. *Submit original advertisement or a copy of the advertisement with an affidavit of publication for each announcement as documentation*.

Name of publication: _____
Date(s) of advertisement: _____
Specific subcontract areas announced: _____

c. Other, if applicable: List each notification method in which an announcement or outreach was used; list serve, public meeting, etc. *Submit applicable information to document effort*.

Method of notification: _____
Date(s) of notification: _____

(iii). Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs; including dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

☐ The prime contractor certifies that the project was broken into its basic elements (i.e., dirt hauling, landscaping, painting, pipe installation, material supplies, etc.) and that a determination was made whether it's economically feasible to bid the elements separately and that the analysis of this effort was documented with a short memo to the project file.

(iv). Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women's business enterprises.

☐ The prime contractor certifies that they established delivery schedules which would allow DBEs to participate in the project and the effort was documented with a short memo to the project file.

(v). Use the services and assistance of the Small Business Administration (SBA). The easiest way to utilize their services is to visit the SBA webpage and use the electronic tools available there or you may send the nearest SBA office a certified letter that generally describes the solicitation, the dates it will be open, the types of vendors you are seeking and applicable Standard Industrial Classification (SIC) or North American Industry Classification System (NAIC) codes if known. Or, you may use the services and assistance of the Kentucky Procurement Technical Assistance Center (PTAC) **and** the Kentucky Department of Transportation (KDOT). The easiest way to utilize the services of Kentucky PTAC and KDOT is to send an email to kyptacinfo@kstc.com and Melvin.Bynes2@ky.gov and generally describe the solicitation, the dates it will be open, the types of vendors you are seeking and applicable SIC or NAIC codes if known.

☐ The prime contractor certifies that the assistance of the SBA or PTAC **and** KDOT was utilized. *Submit pages printed off the SBA websites which evidence efforts to register a solicitation on the site or submit copies of the letter sent and certified mail receipt as documentation; or submit copies of emails sent to PTAC and DOT as documentation*.

(vi). If a Prime contractor awards any subcontracts, require the subcontractor to take the steps in numbers (i) through (v) above.

☐ The prime contractor certifies that subcontractors used for this project will be required to follow the steps of the "six good faith efforts" as listed above.

9. Signature and date:

To the best of my knowledge and belief, all "six good faith efforts" have been met and the information contained in this document is true and correct; the document has been duly authorized by the legal representative.

_____ _____

Signature Print name and title

_____

Date

BIDDER'S LIST FORM

OWNER: _____ **LOAN NO:** _____

PROJECT TITLE: _____ **BID DATE:** _____

Instructions:

1. Per 40 CFR §33.501(b), this list must include all firms that were solicited for participation, bid on, or quoted for a prime contract or subcontract under EPA assisted projects, includes both DBE's and non DBE's.
2. SRF loan participants must keep the Bidder's List until the project period for the identified loan has ended and no funds are remaining.
3. This list must be submitted to DOW in the ATA Package. Contract Award Approval cannot be given until this form has been received by DOW.
4. The following information must be obtained from all prime and subcontractors. Please complete the form below:

ENTITY'S NAME	MAILING ADDRESS	CONTACT PERSON	PHONE#	E-MAIL ADDRESS	M/WBE?

Attachment Number 12

BONDS AND INSURANCE

The minimum requirements shall be as follows:

Bonding requirements for contracts of $100,000 or less are contained in 40 CFR 31.36(h).

Bond requirements for contracts in excess of $100,000 are:

- Bid guarantee equivalent to five percent of the bid price. The bid guarantee shall consist of a firm commitment such as a certified check or bid bond submitted with the bid;
- Performance bond equal to 100 percent of the contract price, and
- Payment bond equal to 100 percent of the contract price. Bonds must be obtained from companies holding Certificates of Authority as acceptable sureties, issued by the U.S. Treasury.

Insurance requirements are contained in the General Conditions of the contract. In addition to the other required insurance, the owner or the contractor, as appropriate, must acquire any flood insurance made available by the Federal Emergency Management Agency as required by 44 CFR Parts 59-79, if construction will take place in a flood hazard area identified by the Federal Emergency Management Agency. The owner's requirements on Flood Insurance are contained in the Special Conditions Section of the Contracts Documents.

Attachment Number 13

STORM WATER GENERAL PERMIT

All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The permit can be found at this webpage.

If you have any questions regarding the completion of this form call the Surface Water Permits Branch, at (502) 564-3410.

DAVIS-BACON WAGE RATE REQUIREMENTS

CWSRF: The recipient agrees to include in all agreements to provide assistance for the construction of treatment works carried out in whole or in part with such assistance made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.), or with such assistance made available under section 205(m) of that Act (33 U.S.C. 1285(m)), or both, a term and condition requiring compliance with the requirements of section 513 of that Act (33 U.S.C. 1372) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions. All contracts and subcontracts for the construction of treatment works carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of $2,000 the contract clauses as set forth below titled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)". This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

DWSRF: The recipient agrees to include in all agreements to provide assistance for any construction project carried out in whole or in part with such assistance made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12), a term and condition requiring compliance with the requirements of section 1450(e) of the Safe Drinking Water Act (42 U.S.C.300j-9(e)) in all procurement contracts and sub-grants, and require that loan recipients, procurement contractors and sub-grantees include such a term and condition in subcontracts and other lower tiered transactions. All contracts and subcontracts for any construction project carried out in whole or in part with assistance made available as stated herein shall insert in full in any contract in excess of $2,000 the contract clauses as set forth below entitled "Wage Rate Requirements Under The Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)". This term and condition applies to all agreements to provide assistance under the authorities referenced herein, whether in the form of a loan, bond purchase, grant, or any other vehicle to provide financing for a project, where such agreements are executed on or after October 30, 2009.

Wage Rate Requirements under the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6)

Preamble

With respect to the Clean Water and Safe Drinking Water State Revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State. Typically, the subrecipients are municipal or other local governmental entities that manage the funds. For these types of recipients, the provisions set forth under Roman Numeral I, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section 3(ii)(A), below and for compliance as described in Section I-5.

Occasionally, the subrecipient may be a private for profit or not for profit entity. For these types of recipients, the provisions set forth in Roman Numeral II, below, shall apply. Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, those subrecipients shall have the primary responsibility to maintain payroll records as described in Section II-3(ii)(A), below and for compliance as described in Section II-5.

I. Requirements under the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) for Subrecipients that are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2013 Continuing Resolution with respect to State recipients and subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient. The recipient or subrecipient may also obtain additional guidance from Department of Labor's webpage.

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor the General Services Administration website weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor the General Services Administration website on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from the General Services Administration website into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage

determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2013 Continuing Resolution, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's General Services Administration website.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division's webpage or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for

the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient**,** upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification.

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office.

II. Requirements under the Consolidated and Further Continuing Appropriations Act, 2013 (P.L. 113-6) for Subrecipients that are not Governmental Agencies

The following terms and conditions specify how recipients will assist EPA in meeting its DB responsibilities when DB applies to EPA awards of financial assistance under the FY2013 Continuing Resolution with respect to subrecipients that are not governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient for guidance. The recipient or subrecipient may also obtain additional guidance from DOL's webpage.

Under these terms and conditions, the subrecipient must submit its proposed DB wage determinations to the State recipient for approval prior to including the wage determination in any solicitation, contract task orders, work assignments, or similar instruments to existing contractors.

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2013 Continuing Resolution, Davis-Bacon prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients must obtain proposed wage determinations for specific localities from the U.S. Department of Labor's General Services Administration website. After the Subrecipient obtains its proposed wage determination, it must submit the wage determination to (insert contact information for State recipient DB point of contact for wage determination) for approval prior to inserting the wage determination into a solicitation, contract or issuing task orders, work assignments or similar instruments to existing contractors (ordering instruments unless subsequently directed otherwise by the State recipient Award Official).

(b) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor the U.S. Department of Labor's General Services Administration website on a weekly basis to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall monitor the U.S. Department of Labor's General Services Administration website on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(c) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from the U.S. Department of Labor's General Services Administration website into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract

or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the subrecipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2013 Continuing Resolution, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's General Services Administration website.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient(s) to the State award official. The State award official will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request, and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The subrecipient(s) shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the

site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division's webpage or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and

Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act.

These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The subrecipient shall upon the request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (a)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification.

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office or its successor site.

Attachment Number 15

AMERICAN IRON AND STEEL REQUIREMENT

The Contractor acknowledges to and for the benefit of the _____ ("Purchaser") and the State of Kentucky (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement.

The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser).

While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Sample Certification

The following information is provided as a sample letter of step certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name
Company Address
City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

An EPA Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE[1] subcontractor[2] the opportunity to describe work received and/or report any concerns regarding the EPA-funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the EPA DBE Coordinator at any time during the project period of performance.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Received from the Prime Contractor Involving Construction, Services , Equipment or Supplies	Amount Received by Prime Contractor

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

OMB Control No:
Approved:
Approval Expires:

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

Please use the space below to report any concerns regarding the above EPA-funded project:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

This form is intended to capture the DBE[1] subcontractor's[2] description of work to be performed and the price of the work submitted to the prime contractor. An EPA Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package.

Subcontractor Name	Project Name	
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.	Email Address	
Prime Contractor Name	Issuing/Funding Entity:	

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving Construction, Services , Equipment or Supplies	Price of Work Submitted to the Prime Contractor

DBE Certified By: ___ DOT ___ SBA ___ Other: _____	Meets/ exceeds EPA certification standards? ___ YES ___ NO ___ Unknown

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

OMB Control No:
Approved:
Approval Expires:

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

Subcontractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

United States Environmental Protection Agency

OMB Control No: 2090-0030
Approved: 8/13/2013
Approval Expires: 8/31/2015

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE[1] subcontractors[2] and the estimated dollar amount of each subcontract. An EPA Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name
Bid/ Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact
Address		
Telephone No.		Email Address
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	___ YES	___ NO
If yes, please complete the table below. If no, please explain:		

Subcontractor Name/ Company Name	**Company Address/ Phone/ Email**	**Est. Dollar Amt**	**Currently DBE Certified?**

Continue on back if needed

[1] A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

[2] Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

United States Environmental Protection Agency

OMB Control No:
Approved:
Approval Expires:

Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Utilization Form

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	**Date**

The public reporting and recordkeeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment

The Contractor hereby acknowledges to and for the benefit of the _____ ("Owner") and the State of Kentucky (the "State") that it understands and agrees that it is required to comply with all terms of 2 CFR 200.216, Prohibition on certain telecommunication and video surveillance services or equipment, which among other requirements prohibits the use of Loan proceeds by the Participant to procure (by means of entering into, extending, or renewing contracts) or obtain equipment, systems or services that use "covered telecommunications equipment or services" identified in the regulation as a substantial or essential component of any Drinking Water or Wastewater System, or as critical technology as part of any Drinking Water or Wastewater System. Such prohibitions extend to the use of Loan proceeds by the Participant to enter into a contract with an entity that "uses any equipment, system, or service that uses covered telecommunications equipment or services" as a substantial or essential component of any Drinking Water or Wastewater System, or as critical technology as part of any Drinking Water or Wastewater System. The Participant represents and warrants that it has not procured or obtained from Loan proceeds equipment, systems or services that use "covered telecommunications equipment or services" identified in the regulation as a substantial or essential component of any Drinking Water or Wastewater System, or as critical technology as part of any Drinking Water or Wastewater System. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner and the State to recover as damages against the Contractor (and the Contractor shall indemnify and hold the Owner and the State harmless against) any loss, expense or cost (including without limitation attorney's fees) incurred by the Owner or the State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Owner). While the Contractor has no direct contractual privity with the Authority, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

"General Decision Number: KY20260042 05/18/2026

State: Kentucky

Construction Types: Building

Counties: Kentucky Counties of
Barren, Casey, Clinton, Cumberland,
Green, Hart, Knox, Logan, Marion,
McCreary, Metcalfe, Monroe, Russell,
Taylor and Wayne

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ASBE0046-002 03/01/2025

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 30.24	18.54

BOIL0040-001 01/01/2025

	Rates	Fringes
BOILERMAKER	$ 43.85	28.44

CARP1650-010 06/01/2024

	Rates	Fringes
CARPENTER (EXCLUDES ACOUSTICAL CEILING INSTALLATION, DRYWALL HANGING, AND METAL STUD INSTALLATION)	$ 32.25	18.09

ELEC0317-005 06/02/2025

	Rates	Fringes
ELECTRICIAN	$ 41.15	29.35

ELEV0011-001 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC PAID HOLIDAYS: A. NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, VETERN'S DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING, AND CHRISTMAS DAY. B. EMPLOYER CONTRIBUTES 8% OF REGULAR HOURLY RATE TO VACATION PAY CREDIT FOR EMPLOYEE WHO HAS WORKED IN BUSINESS MORE THAN 5 YEARS; 6% FOR LESS THAN 5 YEARS' SERVICE	$ 57.41	38.44

ENGI0181-083 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR: BOBCAT/SKID STEER/SKID LOADER	$ 41.98	19.60

ENGI0181-084 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR (OILER)	$ 34.99	19.60

ENGI0181-085 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR: CRANE CRANES WITH BOOM 150 FEET & OVER, INCLUDING JIB, SHALL RECEIVE $.75 ABOVE THE WAGE RATE. ALL CRANES WITH PILING LEADS WILL RECEIVE $.50 ABOVE THE WAGE, REGARDLESS OF BOOM LENGTH	$ 41.98	19.60

ENGI0181-086 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR: FORKLIFT	$ 41.98	19.60

ENGI0181-092 06/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR: BULLDOZER	$ 41.98	19.60

IRON0769-005 06/01/2025

	Rates	Fringes
IRONWORKER, REINFORCING ZONE 3 - (ADD $2.00 PER HOUR TO BASE RATE) 50 MILE RADIUS & OVER OF UNION HALL, 1643 GREENUP AVE, ASHLAND, KY	$ 41.70	29.59
IRONWORKER, REINFORCING ZONE 2 - (ADD $0.40 PER HOUR TO BASE RATE) 10 TO 50 MILE RADIUS OF UNION HALL, 1643 GREENUP AVE, ASHLAND, KY	$ 40.10	29.59
IRONWORKER, REINFORCING (ZONE 1)	$ 39.70	29.59

LABO0189-007 06/01/2025

	Rates	Fringes
LABORER: PIPELAYER	$ 28.53	17.38

LABO0576-011 07/01/2025

	Rates	Fringes
LABORER: CARPENTER TENDER	$ 26.69	13.32

LABO0576-012 07/01/2025

	Rates	Fringes
LABORER: MASON TENDER - CEMENT/CONCRETE	$ 26.89	13.32

LABO1392-004 07/01/2025

	Rates	Fringes
LABORER: MASON TENDER - BRICK	$ 28.16	17.55

PAIN1072-005 12/01/2024

	Rates	Fringes
PAINTER (SPRAY ONLY)	$ 34.29	23.95

PLUM0452-014 11/01/2024

	Rates	Fringes
PIPEFITTER	$ 41.00	21.66

SFKY0669-001 04/01/2025

	Rates	Fringes
SPRINKLER FITTER (FIRE SPRINKLERS)	$ 44.15	26.08

SHEE0110-006 06/01/2025

	Rates	Fringes
SHEET METAL WORKER (EXCLUDES HVAC DUCT INSTALLATION)	$ 40.32	25.66

SUKY2015-023 06/02/2015

	Rates	Fringes
TRUCK DRIVER: DUMP TRUCK	$ 17.07	6.25
TILE SETTER	$ 25.77	6.10
TILE FINISHER	$ 17.67	7.45
SHEET METAL WORKER (HVAC DUCT INSTALLATION ONLY)	$ 25.91	8.06
ROOFER	$ 22.31	7.41
PLUMBER	$ 33.41	16.67
PAINTER (BRUSH AND ROLLER)	$ 18.20	6.43
OPERATOR: GRADER/BLADE	$ 24.33	13.00
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE	$ 21.11	13.00
LABORER: COMMON OR GENERAL	$ 16.97	6.11
IRONWORKER, STRUCTURAL	$ 22.31	15.40
CEMENT MASON/CONCRETE FINISHER	$ 27.99	0.00
BRICKLAYER	$ 24.61	11.88

UAVGKY0007 01/01/2025

	Rates	Fringes
IRONWORKER: ORNAMENTAL	$ 36.73	27.05

UAVGKY0008 01/01/2025

	Rates	Fringes
LABORER: POWER TOOL OPERATOR	$ 28.73	19.36

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or

extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than
SU, UAVG, SA, or SC denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The SU identifier indicates that either a single non-union

rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

�SU wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The �SA identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the �SA identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage

and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

"General Decision Number: KY20260058 05/18/2026

State: Kentucky

Construction Types: Heavy

Counties: Kentucky Counties of
Adair, Barren, Casey, Clinton,
Cumberland, Green, Hart, Knox, Laurel,
Logan, Marion, McCreary, Metcalfe,
Pulaski, Russell, Simpson, Taylor, Wayne
and Whitley

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

CARP0064-007 04/01/2025

	Rates	Fringes
CARPENTER (FORM WORK ONLY)	$ 33.89	24.06

ELEC0369-004 09/04/2024

	Rates	Fringes
LINE CONSTRUCTION: LINEMAN	$ 43.84	18.80
LINE CONSTRUCTION: GROUNDMAN	$ 25.77	14.10
LINE CONSTRUCTION: EQUIPMENT OPERATOR	$ 39.15	17.58

ENGI0181-010 07/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR GROUP 4 OILER OPERATORS ON CRANES WITH BOOMS 150 FEET AND OVER (INCLUDING JIB) SHALL RECEIVE $1.00 ABOVE GROUP 1 RATE; 250 FEET AND OVER INCLUDING JIB SHALL RECEIVE $1.50 ABOVE CLASS 1 RATE. COMBINATION RATE: ALL CRANE OPERATORS OPERATING CRANES, WHERE THE LENGTH OF THE BOOM IN COMBINATION WITH THE LENGTH OF THE PILING LEADS EQUAL OR EXCEEDS 150 FEET, SHALL RECEIVE $1.00 ABOVE THE GROUP 1 RATE. EMPLOYEES ASSIGNED TO WORK BELOW GROUND LEVEL ARE TO BE PAID 10% ABOVE BASIC WAGE RATE. THIS DOES NOT APPLY TO OPEN CUT WORK	$ 38.37	9.50
POWER EQUIPMENT OPERATOR GROUP 2 BOBCAT/SKID STEER/SKID LOADER; FORKLIFT OPERATORS ON CRANES WITH BOOMS 150 FEET AND OVER (INCLUDING JIB) SHALL RECEIVE $1.00 ABOVE GROUP 1 RATE; 250 FEET AND OVER INCLUDING JIB SHALL RECEIVE $1.50 ABOVE CLASS 1 RATE. COMBINATION RATE: ALL CRANE OPERATORS OPERATING CRANES, WHERE THE LENGTH OF THE BOOM IN COMBINATION WITH THE LENGTH OF THE PILING LEADS EQUAL OR EXCEEDS 150 FEET, SHALL RECEIVE $1.00 ABOVE THE GROUP 1 RATE. EMPLOYEES ASSIGNED TO WORK BELOW GROUND LEVEL ARE TO BE PAID 10% ABOVE BASIC		

WAGE RATE. THIS DOES NOT APPLY TO OPEN CUT WORK....$ 38.69 9.50
POWER EQUIPMENT OPERATOR GROUP 1 CRANE; DRILL;
GRADER/BLADE; MECHANIC; SCRAPER OPERATORS ON
CRANES WITH BOOMS 150 FEET AND OVER (INCLUDING JIB)
SHALL RECEIVE $1.00 ABOVE GROUP 1 RATE; 250 FEET
AND OVER INCLUDING JIB SHALL RECEIVE $1.50 ABOVE
CLASS 1 RATE. COMBINATION RATE: ALL CRANE
OPERATORS OPERATING CRANES, WHERE THE LENGTH OF THE
BOOM IN COMBINATION WITH THE LENGTH OF THE PILING
LEADS EQUAL OR EXCEEDS 150 FEET, SHALL RECEIVE
$1.00 ABOVE THE GROUP 1 RATE. EMPLOYEES ASSIGNED
TO WORK BELOW GROUND LEVEL ARE TO BE PAID 10% ABOVE
BASIC WAGE RATE. THIS DOES NOT APPLY TO OPEN CUT
WORK.....$ 41.55 9.50

IRON0782-010 08/01/2025

	Rates	Fringes
IRONWORKER (PROJECTS UNDER $20,000,000.00).....	$ 35.63	26.49
IRONWORKER (PROJECTS OVER $20,000,000.00).....	$ 37.47	26.49

LABO0189-014 07/01/2025

	Rates	Fringes
LABORER: CONCRETE WORKER.....	$ 26.87	19.66
LABORER: CONCRETE SAW (HAND HELD/WALK BEHIND).....	$ 27.12	19.66

SUKY2011-014 06/25/2014

	Rates	Fringes
OPERATOR: LOADER.....	$ 30.35	0.00
OPERATOR: BULLDOZER.....	$ 21.72	7.45
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE.....	$ 23.60	12.65
LABORER: PIPELAYER.....	$ 20.13	8.63
LABORER: FLAGGER.....	$ 18.31	8.89
LABORER: COMMON OR GENERAL.....	$ 20.60	9.39
ELECTRICIAN.....	$ 32.35	2.18
CEMENT MASON/CONCRETE FINISHER.....	$ 21.60	10.35

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.
==========
Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the
Davis-Bacon Act for which the contract is awarded (and any
solicitation was issued) on or after January 1, 2017. If this
contract is covered by the EO, the contractor must provide
employees with 1 hour of paid sick leave for every 30 hours
they work, up to 56 hours of paid sick leave each year.
Employees must be permitted to use paid sick leave for their
own illness, injury or other health-related needs, including
preventive care; to assist a family member (or person who is
like family to the employee) who is ill, injured, or has other
health-related needs, including preventive care; or for reasons
resulting from, or to assist a family member (or person who is
like family to the employee) who is a victim of, domestic
violence, sexual assault, or stalking. Additional information
on contractor requirements and worker protections under the EO
is available at
https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject
to the Davis-Bacon Act that were awarded on or between January 1,

2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ❓SU❓, ❓UAVG❓, ❓SA❓, or ❓SC❓ denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ◆SU◆ identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

◆SU◆ wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ◆SA◆ identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ◆SA◆ identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the

decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The contract shall include but not be limited to the work described in these specifications.

B. Project Identification: **WATER TREATMENT PLANT IMPROVEMENTS** for Lebanon Water Works Company, Inc.

C. Engineer: Kentucky Engineering Group, PLLC. Versailles Kentucky 40383

D. The following major work items are included in the Contract: A new granular activated carbon(GAC) filtration facility and an onsite generation disinfection system and all related appurtenances.

E. The Contractor shall include all materials, labor and equipment necessary to complete all site work. The contract Documents are intended to provide the basis for completion of the work suitable for the intended use of the Owner. Anything not expressly set forth but which is reasonably implied or necessary for proper performance of the Project shall be included.

F. All work shall be in accordance with these Specifications and include all work necessary for a finished product.

G. All excavation is bid unclassified.

H. Continuous operations: The existing system must be maintained in continuous operation in such a manner that it meets all local, state, and federal requirements. The contractor is responsible not to deactivate, demolish, or interfere with any system component required for the continuous operation until a new or temporary permanent-like system has been installed and is operational. The Contractor is responsible for payment of all fines resulting from any action or inaction on his part or the part of his subcontractors during performance of the Work that causes the facility/facilities to operate in an illegal manner or fail to operate in a legal manner.

Use of Site: Limit use of site to public right-of-way. Do not disturb portions of project site beyond areas in which the Work is indicated.

1. Limits: Confine constructions operations to public right-of-way.
2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

PART 2 – PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

- END OF SECTION –

SECTION 01015

WORK SEQUENCE

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall submit to the Engineer for review and acceptance a complete schedule of his proposed sequence of construction operations and payment prior to commencement of work. However, the Engineer shall not accept a construction schedule that fails to utilize the entire time allocated for the construction of the water treatment plant. This schedule requirement in no way prevents the Contractor from completing the project in a shorter time frame than scheduled. The construction schedule shall be submitted and approved by the Owner prior to the submittal of the first partial payment request. A revised construction schedule shall be submitted with every subsequent partial payment request. This revised schedule must be approved by the Owner prior to payment.

1.02 RELATED WORK

A. Section 01010 - Summary of Work.

1.03 CONTRACTOR'S CONSTRUCTION SEQUENCE, SCHEDULE & PROVISIONS

The Contractor shall be responsible for all planning, coordination and execution of the work. The sequence of work shall provide assurances that reliable treatment plant operation will be maintained and such sequences shall be approved by the Owner and the Engineer. No cost or schedule adjustments shall be given for changes to the construction sequence not approved by the Owner and Engineer.

The Contractor's proposed construction sequence schedule must allow the Owner to maintain full operation of their existing water treatment plant during the construction period. The Contractor shall take all necessary precautions to minimize, if not totally eliminate, the disruption in treatment operations. When a disruption in the operations is required, the Contractor shall coordinate in advance (5 days minimum) the interruption with the Owner and the Engineer. The interruptions shall be held to a minimum by wise and prudent coordination of the Contractor's work efforts. Some items of new construction will have to be completed prior to the removal from service and/or renovation of existing facilities.

The contractor shall be responsible for all damages brought about by the disruption of the operation if such disruptions are a direct cause of Contractor negligence and/or a failure of the Contractor to coordinate his work effort to minimize and/or eliminate disruptions in service.

Some general constraints to the Contractor's construction sequence are noted as follows:

A. Total and/or partial plant shut-downs shall be scheduled with the Owner and Engineer and at no time shall the treatment plant be out of service. When performing work on the filters, only one filter shall be out of service at a time. Consideration will be given for two filters out of service at a time depending on the time of year or for shorter durations (+/- 4 hours).

B. The contractor shall submit a sequence of construction for the work associated with the existing filter piping/valve modifications. The following is one example of a general sequence. Other sequences will be considered if submitted by the Contractor.

   a. Backwash piping/valves: Start with Filter 1 vertical piping then Filter 2 crossover piping. Following this same pattern for the remaining Filters 3 thru 8. Provide blind flanges as required for sequencing backwashing of filters in service.

   b. Install 20" FE, 20" GACE & new valve vault including piping and valves.

c. Filter effluent piping/valves: Start with piping/valve changes to Filters 8 & 6 and then proceed for Filters 7 & 5, Filters 4 & 3 and then Filters 2 & 1. Chemical feed modifications will be required for Fluoride and Chlorine.

B. In general, provide all necessary electrical infrastructure to facilitate the installation of new equipment or replacement of existing equipment, where work does not adversely affect the operation of the existing facility. To greatest extent possible, have electrical system in place and ready for energizing where equipment is to be installed or replaced. Do not demolish any equipment (motor control centers, panelboards, etc.) that would be critical to the operation of the existing facility until provisions have been made to accommodate loss of the demolished item.

C. The existing SCADA system must remain operational during all phases of construction and at no time shall the system be out of service.

D. Chemical feed capabilities must be maintained at all times during construction. The Contractor shall maintain all roadways to allow for delivery of chemical feed supply. It shall be the Contractor's responsibility during the duration of the construction project to provide assistance, including all labor, material, and equipment, as required to maintain, load, unload, and provide as-needed temporary facilities and undisturbed delivery of chemicals to the proper location and feed point of the treatment plant. The Contractor at all times shall provide access for delivery of chemicals to the facility.

E. Contractor shall provide all temporary piping and pumping which may be required for construction of the treatment plant.

F. After each piece of equipment is successfully started-up, the Contractor shall "Video Tape" the Owner's training administered by the particular piece of equipment's factory Representative. The tape shall be given to the Owner on a portable hard drive "thumb drive" for future reference.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

- END OF SECTION -

SECTION 01016

OCCUPANCY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall be aware that after each major portion of the project is completed, the Contractor shall notify the Engineer that those specific operations are complete and prior to replacing that portion of the work into service shall request an interim inspection of the work to be returned to or placed into service.

B. The interim inspection requested by the Contractor shall not preclude or supersede the final inspection of the project or reduce the Contractor's responsibility for the completed portion prior to final acceptance of the work by the Owner.

C. The Contractor shall provide all necessary temporary controls and other items required for operation of all work placed into service prior to final acceptance as required. At such time as new controls, etc. are complete and functioning, the Contractor shall remove all temporary installed items.

- END OF SECTION -

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials, service and other necessary supplies and perform all work shown on the Drawing and/or described in the Specifications and Contract Documents at the lump sum price as indicated by the Bidder in the Bid.

B. The Bidder declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examine the Plans, Specification and Contract Documents for the Work, and has read all special provisions furnished prior to the opening of bids; and that he has further satisfied himself relative to the Work to be performed.

C. All excavation required of the work shall be done as part of the total price for the complete project. All excavation shall be unclassified.

D. Owner shall make payments on account of the Contract Price on the basis of Contractor's applications for Payment as recommended by the Engineer, on or about the ___ day of each month during construction. All progress payments will be on the basis of the progress of the Work measured by the Schedule of Values established in Paragraph 2.07 of the General Conditions or, in the event there is no schedule of values, as provided in the General Requirements

E. The Progress payments shall include the cost of Stored Materials plus 95% of the work completed to date. Stored materials are defined as materials and equipment not incorporated in the Work but delivered, suitably stored and accompanied by documentation satisfactory to the Owner as provided in Article 15 of the General Conditions. The 5% is held as retainage.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable0

- END OF SECTION -

SECTION 01030

LABOR PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall conform to all provisions of the Kentucky Department of Labor, Wage Decisions (latest revisions), relative to minimum wages and hours as they may apply to the work to be accomplished under these specifications.

B. In addition to the above, certain Federal laws and regulations shall govern the work and shall supplement or supplant the Kentucky Department of Labor Wage Decisions cited above, as the case may be.

C. The contractor shall be compliant with OSHA (P.L. 91-596) and the Contract Work Hours and Safety Standards Act (P.L. 91-54)

1.02 RELATED SECTIONS

A. Section 3 - Part 1 Hours and Wages

1.03 WAGE RATES

Prevailing wage rates apply to this job. The Contractor will utilize, when feasible, local labor Community.

1.04 LABOR PREFERENCE

Where feasible, the Contractor will utilize local labor.

1.05 HOURS OF WORK

A. Hours of work shall be as set out in Kentucky Department of Labor Wage Decisions (latest revisions); that is, not more than eight (8) hours in one calendar day, nor more than forty (40) hours in one week, except in case of emergency caused by fire, flood or damage to life and property.

B. Any laborer, workman, mechanic, helper, assistant or apprentice working in excess of forty (40) hours per week, except in case of emergency, shall be paid not less than 1-1/2 times the wage rate. Whenever overtime work is scheduled, the Contractor shall give prior notice to the Owner.

1.06 OVERTIME WORK

A. Any overtime work (greater than 40 hours in one week) shall require the Contractor to reimburse the Owner for additional resident inspection costs at an hourly rate of $65.00 per hour.

- END OF SECTION -

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.01 COORDINATION OF THE WORK

The Contractor shall coordinate the work of all the crafts, trades and subcontractors engaged on the Work, and he shall have final responsibility as regards the schedule, workmanship and completeness of each and all parts of the Work.

All crafts, trades and subcontractors shall be made to cooperate with each other and with others as they may be involved in the installation of work which adjoins, incorporates, precedes, or follows the work of another. It shall be the Contractor's responsibility to point out areas of cooperation prior to the execution of subcontract agreements and the assignment of the parts of the Work. Each craft, trade and subcontractor shall be made responsible to the Owner, for furnishing embedded items, giving directions for doing all cutting and fitting, making all provisions for accommodating the Work, and for protecting, patching, repairing, and cleaning as required to satisfactorily perform the Work.

The Contractor shall be responsible for all cutting, digging and other action of his subcontractors and workmen. Where such action impairs the safety or function of any structure or component of the Project, the Contractor shall make such repairs, alterations, and additions as will, in the opinion of the Engineer, bring said structure or component back to its original design condition at no additional cost to the Owner.

Each subcontractor is expected to be familiar with the General Requirements and all sections of the Detailed Specifications for all other trades and to study all Drawings applicable to his work to the end that complete coordination between trades will be affected. Each Contractor shall consult with the Engineer if conflicts exist on the Drawings.

The Contractor shall conduct testing in a timely manner.

- END OF SECTION -

SECTION 01200

SUBSTITUTIONS

PART 1 - GENERAL

A. If the CONTRACTOR wishes to furnish or use a substitute item of material or equipment or construction method he shall make written application to the Contracting Officer within thirty (30) days after execution of the Contractor, certifying that the proposed substitute will perform adequately the functions called for by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same functions as that specified. Requests for review of substitute items of material and equipment will not be accepted by the ENGINEER from anyone other than CONTRACTOR.

B. In making request for substitution, CONTRACTOR represents:

1. He has personally investigated proposed product or method and determined that it is equal or superior in all respects to that specified.

2. He will provide the same or better guarantee for substitution as for product or method specified.

3. He will coordinate installation of accepted substitution into work, making such changes as required in all respects.

4. He waives all claims for additional costs related to substitution that consequently become apparent.

5. Cost data is complete and includes all related costs under this Contract.

1.01 SUBMITTALS

A. The CONTRACTOR shall submit six (6) copies of requests for substitution. Include in request the following:

1. Complete data substantiating compliance of proposed substitution with Contract Documents.

2. Indication whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.

3. For Products:

a. Product identification, including manufacturer's name and address.

b. Manufacturer's literature with product description, performance and test data, and reference standards.

c. Samples.

d. Name and address of similar projects on which product was used, data of installation, and product performance and maintenance records.

4. For Construction Methods:

a. Detailed description of proposed method.

b. Drawings illustrating methods.

5. Itemized comparison of proposed substitution with product or method specified.

6. Data relating to changes in construction schedule.

7. Relation to separate contracts, if any.

8. Accurate cost data on proposed substitution in comparison with product or method specified.

D. Substitutions will not be accepted if:

1. They are only shown or implied on Shop Drawings.

2. Acceptance will require substantial revision of Contract Documents.

3. Substitutions would change design concepts or Specifications.

4. Substitutions would delay completion of the Work.

5. Substitutions involve items for which a manufacturer was declared at time of bidding.

E. The ENGINEER will determine whether substitute brands or products are equal to those specified in the Contract Documents. No substitute will be ordered or installed without the ENGINEER's prior written acceptance.

F. The OWNER may require CONTRACTOR to furnish at CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute.

G. If the ENGINEER determines that a substitute is not equal to that named in the Specifications, the CONTRACTOR shall furnish one of the brands or products specified, at no additional cost to the OWNER.

H. The time required by the ENGINEER to evaluate and either accept or reject proposed substitutes is included in the Contract Time and no extension of the Contract Time shall be allowed therefore.

1.02 ENGINEERING COSTS

A. The ENGINEER will record all time required in evaluating substitutions proposed by CONTRACTOR and in making any change in the Drawings or Specifications occasioned thereby. Whether or not the ENGINEER accepts a proposed substitute, the CONTRACTOR will reimburse the OWNER for the actual costs of the ENGINEER for evaluating any proposed substitute which either does not meet the requirements of the Drawings and Specifications, or the acceptance of which would require changes to other portions of the work.

B. CONTRACTOR shall reimburse OWNER for all associated engineering costs, including redesign, additional shop drawing reviews, investigations, consultant fees and revision of the Contract Documents required because of the substitution.

- END OF SECTION -

SECTION 01210

ALLOWANCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes administrative and procedural requirements governing allowances. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.

C. The following allowances shall be included in the Contractors Bid:

1. **Granular Activated Carbon Media (lump sum)**

   FILTRASORB 300M as manufactured by Calgon Carbon Corporation or GAC300 as manufactured by Norit or approved equal.

   Allowance Amount: **$560,000.00**

2. **Electronic Project Documentation & Communication** (lump sum)

   eCommunication by Lynn Imaging, (502) 499-8400, www.lynnimaging.com

   Allowance Amount: **$8,000.00**

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section

1.3 ELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections and include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Engineer from the designated supplier.

D. When an allowance is included for a third party, Independent Testing Agency, the Testing Agency shall be determined by the Owner.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

D. Submit copy of all testing results as provided by the Testing Agency to the Engineer.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM & UNIT-COST ALLOWANCES

A. Allowances shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to the project site.

B. Contractor's costs for receiving and handling at Project site, labor, coordination, concrete cylinder preparation and shipping, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 UNUSED MATERIALS

A. Contractor shall be responsible for returning unused materials purchased under an allowance to the manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

B. When it is not economically practical to return material for credit, Contractor shall be responsible for preparing and delivering unused material to Owner’s designated storage location. Otherwise, disposal of unused material shall be Contractor’s responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED

Shop drawings, descriptive literature, project data and samples (when samples are specifically requested) for all manufactured or fabricated items shall be submitted by the Contractor to the Engineer for examination and review in the form and in the manner required by the Engineer. All SUBMITTALS shall be furnished in at least six (6) copies and shall be checked, reviewed, and signed by the Contractor before submission to the Engineer. The review of the Drawings by the Engineer shall not be construed as a complete check but only for conformance with the design concept of the Project and for compliance with information given in the Contract Documents. Review of such drawings will not relieve the Contractor of the responsibility for any errors that may exist, as the Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. General Provision.

B. Section 01720 - Project Record Documents (As-Builts).

1.03 DEFINITIONS

The term "submittals" shall mean shop drawings, manufacturer's drawings, catalog sheets, brochures, descriptive literature, diagrams, schedules, calculations, material lists, performance charts, test reports, office and field samples, and items of similar nature which are normally submitted for the Engineer's review for conformance with the design concept and compliance with the Contract Documents.

1.04 GENERAL CONDITIONS

A. Review by the Engineer of shop drawings or SUBMITTALS of material and equipment shall not relieve the Contractor from the responsibilities of furnishing same of proper dimension, size, quality, quantity, materials and all performance characteristics to efficiently perform the requirements and intent of the Contract Documents. Review shall not relieve the Contractor from responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents.

B. Review of shop drawings shall not be construed as releasing the Contractor from the responsibility of complying with the Specifications.

1.05 GENERAL REQUIREMENTS FOR SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be prepared by a qualified detailer. Details shall be identified by reference to sheet and detail numbers shown on Contract Drawings. Where applicable, show fabrication, layout, setting and erection details.

2. Shop drawings are defined as original drawings prepared by the Contractor, subcontractors, suppliers, or distributors performing work under this Contract. Shop drawings illustrate some portion of the work and show fabrication, layout, setting or

erection details of equipment, materials, and components. The Contractor shall, except as otherwise noted, have prepared the number of reviewed copies required for his distribution plus two (2) which will be retained by the Engineer. Shop drawings shall be folded to an approximate size of 8-1/2" x 11" and in such manner that the title block will be in the lower righthand corner of the exposed surface.

B. Project data shall include manufacturer's standard schematic drawings modified to delete information, which is not applicable to the Project, and shall be supplemented to provide additional information applicable to the Project. Each copy of descriptive literature shall be clearly marked to identify pertinent information as it applies to the Project.

C. Where samples are required, they shall be adequate to illustrate materials, equipment, or workmanship, and to establish standards by which completed work is judged. Provide sufficient size and quantity to clearly illustrate functional characteristics of product and material, with integrally related parts and attachment devices, along with a full range of color samples.

D. All submittals shall be referenced to the applicable item, section, and division of the Specifications, and to the applicable Drawing(s) or Drawing schedule(s).

E. The Contractor shall review and check SUBMITTALS, and shall indicate his review by initials and date.

F. If the submittals deviate from the Contract Drawings and/or Specifications, the Contractor shall advise the Engineer, in letter of transmittal of the deviation and the reasons therefor. All changes shall be clearly marked on the submittal with a bold red mark. Any additional costs for modifications shall be borne by the Contractor.

G. In the event the Engineer does not specifically reject the use of material or equipment at variance to that which is shown on the Drawings or specified, the Contractor shall, at no additional expense to the Owner, and using methods reviewed by the Engineer, make any changes to structures, piping, controls, electrical work, mechanical work, etc., that may be necessary to accommodate this equipment or material. Should equipment other than that on which design drawings are based be accepted by the Engineer, shop drawings shall be submitted detailing all modification work and equipment changes made necessary by the substituted item.

H. Additional information on particular items, such as special drawings, schedules, calculations, performance curves, and material details, shall be provided when specifically requested in the technical Specifications.

I. Submittals for all electrically operated items (including instrumentation and controls) shall include complete wiring diagrams showing leads, runs, number of wires, wire size, color coding, all terminations and connections, and coordination with related equipment.

J. Equipment shop drawings shall indicate all factory or shop paint coatings applied by suppliers, manufacturers and fabricators; the Contractor shall be responsible for insuring the compatibility of such coatings with the field-applied paint products and systems.

K. Fastener specifications of manufacturer shall be indicated on equipment shop drawings.

L. Where manufacturers' brand names are given in the Specifications for building and construction materials and products, such as grout, bonding compounds, curing compounds, masonry cleaners, waterproofing solutions and similar products, the Contractor shall submit names and descriptive literature of such materials and products he proposes to use in this Contract.

M. No material shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed by the Engineer and returned to the Contractor.

N. All bulletins, brochures, instructions, parts lists, and warranties packaged with and accompanying materials and products delivered to and installed in the Project shall be saved and transmitted to the Owner through the Engineer.

1.06 CONTRACTOR RESPONSIBILITIES

A. Verify field measurements, field construction criteria, catalog numbers and similar data.

B. Coordinate each submittal with requirements of Work and of Contract Documents.

C. Notify Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.

D. Begin no work, and have no material or products fabricated or shipped which required submittals until return of submittals with Engineer's stamp and initials or signature indicating review.

- END OF SECTION -

SECTION 01380

CONSTRUCTION PHOTOGRAPHY

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall be responsible for video taping the entire project site both prior to construction and immediately after completion and acceptance of all work. Video tapes shall be produced by a videographer acceptable to the Engineer and of a professional quality.

1.02 VIDEO TAPE

The video tape shall be of a high-quality format and include the date of recording.

1.03 SUBMITTALS

The Contractor shall provide two copies of the Videos on a portable hard drive or "thumb drive". Both the hard drives shall be clearly labeled with project name start date and completion date as shown below.

Project Name and Contract No.
Owner Name
Start Date: _____
Completion Date: _____

-END OF SECTION-

SECTION 01411 – STRUCTURAL SPECIAL INSPECTION & CONTRACTOR RESPONSIBILITY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. General Conditions of the Construction Contract Inspection of Work / Defective or Incomplete Work / Special Inspections shall apply in its entirety to this project. Where any conflict exists between this Specification Section and the General Conditions, the General Conditions provisions shall supersede in all aspects.

1.2 SUMMARY

A. Special Inspections as defined in Section 1704 of The Kentucky Building Code are required.

B. The Risk Category, Seismic Design Category, and Basic Wind Speed for the structure are shown in the General Notes section of the structural drawings.

C. Special inspections per Kentucky Building Code Sections 1704 and 1705 are required for the following materials and work:

1. Inspection of Fabricators per Section 1704.2.5 of the Kentucky Building Code.
2. Steel Construction per Section 1705.2 of the Kentucky Building Code.
3. Concrete Construction per Section 1705.3 of the Kentucky Building Code.
4. Masonry Construction per Section 1705.4 of the Kentucky Building Code.
5. Prepared Fill per Section 1705.6 of the Kentucky Building Code.
6. Cast-in-Place Deep Foundations per Section 1705.8 of the Kentucky Building Code.
7. Additional materials and work as/if indicated on the Construction Drawings.

D. The structural special inspections required on this project are further defined in the Special Inspections section of the structural drawings. Other, non-structural special inspections may be required and are specified elsewhere if applicable.

1.3 SCOPE

A. The scope of the construction work to be inspected / tested / observed is that structural and foundation work shown on the structural construction drawings (S- sheets) as well as the following:

1. Geotechnical fill immediately below and within the footprint of the building and retaining wall foundations shown on the structural drawings.

2. Rammed Aggregate Pier (Soil Improvements) below the GAC Tanks.

B. All inspections and tests performed shall be documented by report including, but not limited to, inspections for grout and concrete placement, reinforcing inspection, curing, fabricators, deck attachment, etc.

1.4 DEFINITIONS

A. In accordance with the intent of the Building Code, inspection work specified to be "continuous" shall be inspected the full, uninterrupted time that the Contractor is performing said construction work. Work specified to be "periodic" may be inspected as convenient to the Inspector, except that all work must be inspected prior to being covered by other work, during the working hours of the Contractor, and in a fashion that does not delay the Contractor. Regardless as to whether inspections are performed in "continuous" or "periodic" fashion, 100% of the construction work shall be inspected, unless noted otherwise.

1.5 SELECTION AND PAYMENT

A. The Inspection Agency shall be retained by the Owner. Costs for reinspection and retesting, should discrepancies be found, will be paid for by the Owner, except where rework is due to negligence or omission deemed excessive by the Owner.

1. In case of excessive rework, such retesting and reinspection shall be paid for by the Owner as an additional service of the Inspection Agency, but will be backcharged by deductive change order to the Contractor's contract.
2. In case of excessive waste/lost time of the Special Inspector due to inadequate scheduling by the General Contractor, such time shall be paid for by the Owner as an additional service of the Inspection Agency but will be backcharged by deductive change order to the Contractor's contract.

B. Special Inspections are additional to testing and inspection requirements shown elsewhere in the specifications and on the drawings, which are to be paid for by the Contractor. The Contractor shall also pay for additional structural testing and inspection required for their convenience. Inspection work not part of the Structural Special Inspections may be performed by an Inspection Agency of the Contractor's choosing, unless noted otherwise.

1.6 INFORMATIONAL SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

B. Fabricator certificate of current good standing with Qualified Certification Program.

C. Fabricators exempt from special inspection shall submit a *Certificate of Compliance* to the structural engineer of record at the completion of fabrication stating that all work was completed in accordance with the approved construction documents.

1.7 QUALITY ASSURANCE

A. Qualified Certification Authorities: Subject to compliance with Kentucky Building Code Requirements, Qualified Certification Authorities providing certification which may be applicable to Project include:

1. American Concrete Institute (ACI).
2. American Institute of Steel Construction (AISC).
3. American Society of Nondestructive Testing (ASNT).
4. American Welding Society (AWS).
5. Cold Formed Steel Engineers Institute (CFSEI).
6. International Accreditation Service (IAS).
7. International Code Council (ICC).
8. National Institute of Certified Engineering Technology (NICET).

PART 2 – EXECUTION

2.1 PROGRESS MEETINGS

A. The Special Inspector's designated Project Manager is to attend any pre-construction meetings which may be conducted at the construction site by the Structural Engineer to discuss quality issues.

B. The Special Inspector's designated Project Manager is to attend construction progress meetings which will be held at the construction site by the Architect, Engineer, and General Contractor.

2.2 CONTRACTOR'S RESPONSIBILITIES

A. Provide a complete copy of all structural shop drawings to the Structural Testing/Inspection Agency.

B. Coordinate with the Project Manager, Design Professional, and Using Agency to initiate a Pre-Installation Meeting, typically held at the construction site. Arrange and require relevant project managers and site foremen from the Subcontractors to attend the meeting to discuss quality issues.

C. Notify the Structural Testing/Inspection Agency sufficiently in advance of operations to allow assignment of personnel and scheduling of tests.

D. Cooperate with Structural Testing/Inspection Agency and provide access, including equipment with operator, to work. Access equipment includes, but is not limited to, man lifts, excavation equipment, etc.

E. Provide samples of materials to be tested in required quantities.

F. Provide storage space for Structural Testing/Inspection Agency's exclusive use, such as for storing and curing concrete testing samples. If required by Special Inspector, General Contractor shall provide cure box with electricity, water, and blankets for curing concrete specimens.

G. Provide labor to assist the Structural Testing/Inspection Agency in performing tests/inspections. Labor includes, but is not limited to, construction of masonry prisms, etc.

H. Construction and work for which Special Inspection is required shall remain accessible and exposed for special inspection purposes until the completion of the inspections and tests.

I. All parties who are to receive inspection and testing reports shall maintain an active email account to receive reports by.

J. General Contractor shall create and maintain a discrepancy log on site. Log shall list each discrepancy documented by the Special Inspector; state the date of discovery and Special Inspector's report number; and provide room for the Special Inspector to sign and date when said discrepancy is corrected. No work containing a discrepancy shall be covered prior to having reinspection and approval by the Special Inspector.

K. Neither the observation of the Architect/Structural Engineer in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by any other

person(s) shall relieve the Contractor from their obligation to perform the work in accordance with the Contract Documents.

2.3 SPECIAL INSPECTOR'S RESPONSIBILITIES

A. Cooperate with the Contractor and provide timely service.

B. Notify Contractor of minimum advance notice for each type of inspection/test.

C. Upon arriving at the construction site, sign in and notify the Contractor of presence.

D. Select the representative samples that are to be tested/inspected.

E. Perform tests/inspections as outlined in the Contract Documents, the applicable codes, and as directed by the Structural Engineer.

F. Perform Structural Observations as outlined in the Contract Documents, the applicable codes, and as directed by the Structural Engineer-of-Record.

G. Keep records of all inspections.

H. Furnish inspection reports to the Architect, Structural Engineer, and General Contractor weekly as construction progresses.

1. Each report shall include photographs of the project status and the typical work inspected and documented in that subject report. These general photographs are in addition to the required photograph at discrepancies.
2. Format of report deliverables shall be Special Inspection Report (PDF), Project Photographs (JPG), and Related Supporting Documentation (PDF).

I. Inform General Contractor and / or Fabricator of all discrepancies immediately for correction.

1. Document in writing correction of discrepancies.
2. Highlight discrepancies within the report.

a. The report shall include a text description of each discrepancy. Description shall convey the discrepancy location on the project and the issue.
b. The report shall include a photograph of each discrepancy observed in the field and/or in the shop. Photograph shall be labeled to convey location on project and the issue shown. (Photographs of material strength tests for concrete and/or masonry are not required, unless otherwise instructed.)
c. The report shall document the date that each discrepancy was initially discovered.
d. Inspection-related discrepancies shall be reinspected by the Special Inspector along the course of the project and prior to concealment by other work. Subsequent reports shall document the date that prior discrepancy was confirmed to be corrected.

3. If discrepancies are not corrected, the discrepancies shall be brought to the attention of the Code Official and the Structural Engineer prior to the completion of that phase of the work.

J. Leave copies of field notes with the Contractor prior to leaving the construction site. Field notes shall include the message given to the Contractor, date, time of message, name of

Contractor's representative informed, type and location of work or materials tested/inspected, whether the work or materials complies with Contract Documents and name of the Structural Testing/Inspection Agency's representative.

K. Immediately notify General Contractor, Architect, and Structural Engineer by separate letter if work yet to be inspected is found on site that is either being covered by other work or was to receive continuous inspection.

L. Structural Testing/Inspection Agency shall not alter requirements of Contract Documents, approve or reject any portion of the work, or perform duties of the Contractor.

M. Submit a final report of inspections documenting completion of **all** required Special Inspections and correction of any discrepancies noted in inspections to the Structural Engineer. Final report shall be prepared by, sealed, and signed by the Special Inspector and shall include a complete list of materials and work inspected during the course of the project. One copy of said report is to be provided to the Contractor for their records.

END OF SECTION 01411

SECTION 01450

QUALITY CONTROL

PART 1 - GENERAL

1.01 QUALITY CONTROL

A. Work of all crafts and trades shall be laid out to lines and elevations as established by the Contractor from the Drawings or from instructions by the Engineer.

B. Unless otherwise shown, all work shall be plumb and level, in straight lines and true planes, parallel or square to the established lines and levels. The Work shall be accurately measured and fitted to tolerance as established by the best practices of the crafts and trades involved and shall be as required to fit all parts of the Work carefully and neatly together.

C. All equipment, materials and articles incorporated into the Work shall be new and of comparable quality as specified. All workmanship shall be first-class and shall be performed by mechanics skilled and regularly employed in their respective trades.

1.02 TESTS, INSPECTIONS, AND CERTIFICATIONS OF MATERIALS

A. Tests, inspections and certifications of materials, equipment, subcontractors or completed work, as required by the various sections of the Specifications shall be obtained by the Contractor and all costs shall be included in the Contract Price.

B. The Contractor shall submit to the Engineer the name of testing laboratory to be used.

C. Contractor shall deliver notify the Engineer at least 24 hours in advance of any inspections or tests to be made at the Project site. All inspections, tests, samples for water quality or other procedures requiring the Engineer to attest to be conducted in the field shall be done in the presence of the Engineer or his representative.

D. Certifications by independent testing laboratories may be by copy of the attestation(s) and shall give scientific procedures and results of tests. Certifications by persons having interest in the matter shall be by original attest properly sworn to and notarized.

- END OF SECTION -

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall make his own provisions for temporary electricity and water and maintain strict supervision of use of temporary utility services as follows:

1. Enforce compliance with applicable standards.

2. Enforce safety practices

3. Prevent abuse of services.

4. Pay all utility charges required.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. The Contractor shall obtain and pay for all permits as required by governing authorities.

B. Obtain and pay for temporary easements required across property other than that of Owner or that is shown on the Contract Drawings.

C. The Contractor shall comply with applicable codes.

1.03 REMOVAL

A. The Contractor shall completely remove temporary materials, equipment, and offices upon completion of construction.

B. The Contractor shall repair damage caused by installation and restore to specified or original condition.

1.04 TEMPORARY LIGHTING

A. The Contractor shall furnish and install temporary lighting required for:

1. Construction needs.

2. Safe and adequate working conditions.

3. Public Safety.

4. Security lighting.

5. Temporary office and storage area lighting.

B. Service periods for safety lighting shall be as follows:

1. Within construction area: All times that authorized personnel are present.

2. Public areas: At all times.

C. Costs of Installation and Preparation: Contractor shall pay all installation, maintenance and removal costs of temporary lighting.

D. Maintenance of temporary lighting service (replacement of bulbs, etc.) shall be the sole responsibility of the General Contractor.

1.05 TEMPORARY WATER

The Contractor shall provide the water necessary for testing and disinfection. Water purchased from the owner for flushing and testing shall be paid for at the whole sale price by the contractor. The Contractor shall supply his own hoses, chlorine for disinfection, etc.

1.06 SANITARY FACILITIES

Contractor shall provide sanitary facilities as set forth in General Provisions (GP-2.04.Sanitary Regulations).

1.07 FIELD OFFICE (Office Trailer not Required for this Contract)

The Contractor shall make his own provisions for providing the electricity, telephone, gas, water, sewer, and other utilities to his office trailer that are required or as necessary for completion of the work.

The Contractor shall be responsible for all utility charges.

PART 2 - PRODUCTS

Not used.

PART 3 – EXECUTION

3.01 IMPLEMENTATION

B. The Contractor shall provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to storm drains, adjacent areas and walkways prior to the start of any site work.

C. Straw bale dikes, silt fencing and synthetic filter fabric shall be used as necessary to protect adjacent lands, surface waters, and vegetation to achieve environmental objectives.

D. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Soil deposited on pavement by construction and other contractor vehicles shall be removed and the pavement swept as required.

F. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

G. Minimize amount of bare soil exposed at one time.

H. Provide temporary measures such as berms, dikes, drains, hay bales, gabions, etc., as directed by the Engineer so as to minimize siltation due to runoff.

I. Construct fill and waste areas by selective placement to avoid erosive exposed surface of silts or clays.

J. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

3.02 OPERATION AND MAINTENANCE

A. The Contractor shall inspect, repair, and maintain erosion and sediment control measures until final stabilization has been established.

3.03 REMOVAL OF FACILITIES

A. The Contractor shall remove the temporary facilities after final stabilization has been established. Used devices (including old straw bales) shall be disposed of as Construction & Demolition debris.

3.04 DUST CONTROL

A. Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

- END OF SECTION -

SECTION 01540

SECURITY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide barricades, lanterns and other such signs and signals as may be necessary to warn of the dangers in connection with open excavation and obstructions.

B. Provide an adequate and approved system to always secure the Project area, especially during non-construction periods; the Contractor shall be solely responsible for taking proper security measures.

1.02 COSTS

Contractor shall pay all costs for protection and security systems.

- END OF SECTION -

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall provide all signs required by these specifications near the site of the work. The sign shall set forth the description of the work and the names of the Owner, Engineer and Contractor as shown on the Plans or in these Specifications.

B. The Contractor shall furnish and install One (1) sign on the Project. One sign shall conform to the specifications and painted as shown on Figure I on the following page. The location of signs shall be determined by the Owner and/or Engineer at the pre-construction meeting.

PART 2 - PRODUCT

2.01 SIGN

The sign shall be constructed of 3/4" thick APA A-B Exterior grade or marine plywood. Posts shall be 4" x 4" of fencing type material. Prime all wood with white primer. Sign shall be as shown in Figure I and II.

PART 3 - EXECUTION

3.01 MAINTENANCE

The sign shall be maintained in good condition until completion of the Project.

3.02 LOCATION

The location of the project signs shall be determined at the pre-construction conference after the contract has been awarded.

-END OF SECTION-

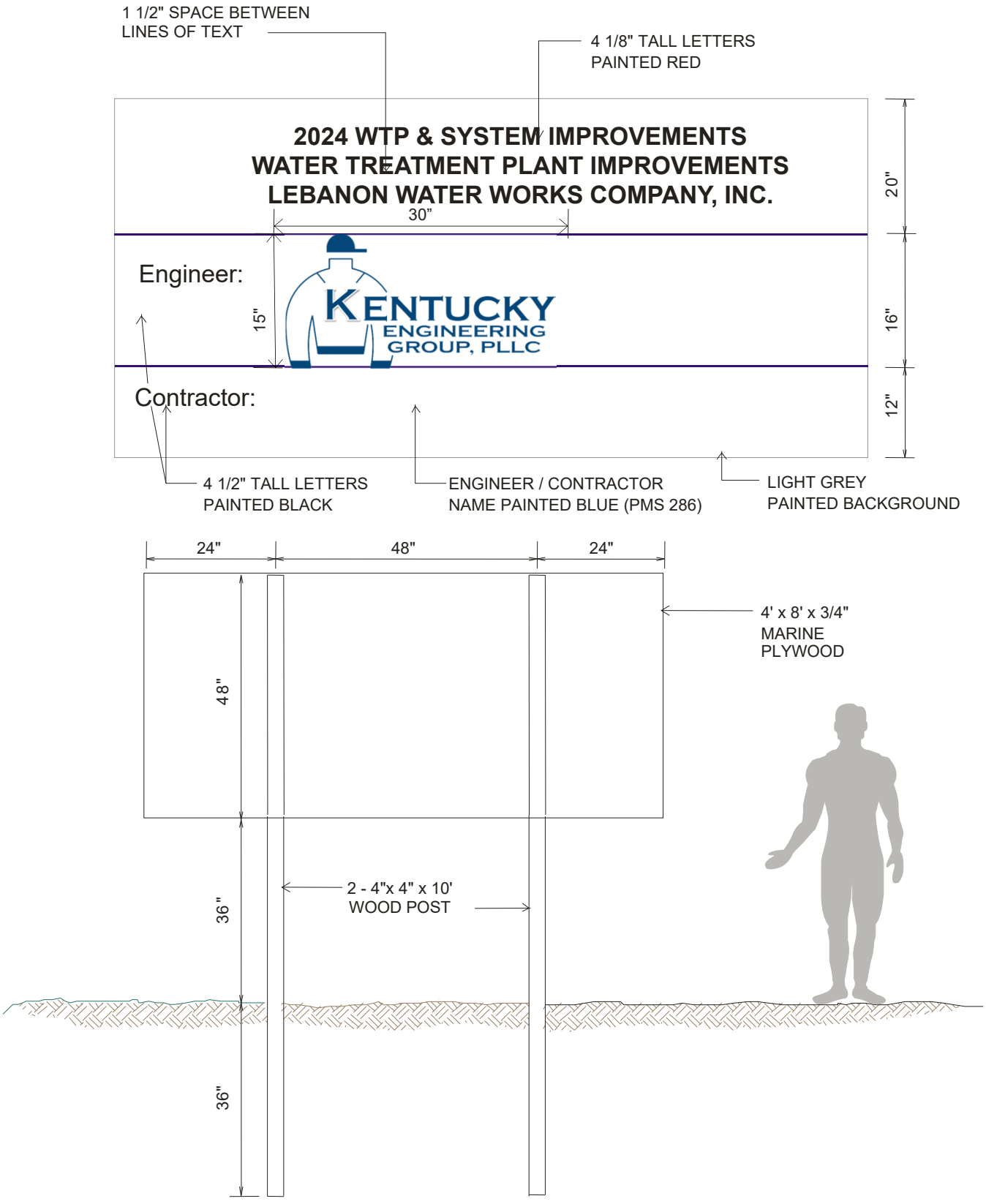


FIGURE 1

01580-2

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 COMPLIANCE WITH SAFETY REGULATIONS

The equipment items furnished shall comply with all governing Federal and State laws regarding safety, including all requirements of the Occupational Safety and Health Act of 1970 (OSHA).

1.02 BUILD AMERICA BUY AMERICA REQUIREMENTS

The contractor acknowledges to and for the benefit of the Lebanon Water Works Company ("owner") and the Kentucky Infrastructure Authority (the "funding authority") that it understands the goods and services under this agreement are being funded with federal monies and have statutory requirements commonly known as "build America, buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the united states ("build America, buy America requirements") including iron and steel, manufactured products, and construction materials provided by the contactor pursuant to this agreement. The contractor hereby represents and warrants to and for the benefit of the owner and funding authority (a) the contractor has reviewed and understands the build America, buy America requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the united states in a manner that complies with the build America, buy America requirements, unless a waiver of the requirements is approved, and (c) the contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the build America, buy America requirements, as may be requested by the owner or the funding authority. Notwithstanding any other provision of this agreement, any failure to comply with this paragraph by the contractor shall permit the owner or funding authority to recover as damages against the contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the owner or funding authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the funding authority or any damages owed to the funding authority by the owner). If the contractor has no direct contractual privity with the funding authority, as a lender or awardee to the owner for the funding of its project, the owner and the contractor agree that the funding authority is a third-party beneficiary and neither this paragraph (nor any other provision of this agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the funding authority.

PART 2 - PRODUCTS

2.01 REFERENCES

A. General Provisions: Section 10 Correction and Guarantee of Work, Section 13 Materials and Equipment.

B. Section 02600 – Pipe, Fittings, and Installation

C. Section 02640 - Valves.

D. All material shall meet applicable American Water Works Association (AWWA), American Standard Testing Methods (ASTM), Underwriters Laboratories (UL), Factory Mutual (FM), National Sanitation Foundation (NSF) standards.

LEBANON WATER WORKS COMPANY, INC.

The following is a list of approved manufacturers for the materials to be provided on the project. All material shall meet applicable AWWA, ASTM, Underwriters Laboratories, and Factory Mutual standards. The Owner approves this list and the Owner and Engineer shall approve any deviation.

MATERIAL/ITEM	APPROVED MANUFACTURER
Air Release Valve	Apco, ARI or Approved Equal
All Brass Fittings (AWWA brass)	Mueller, Ford or Approved Equal
Aluminum Hatch	Bil-Co or Approved Equal
Blowoff Hydrant Assembly	Mueller Model No. A-411 or Approved Equal
Flushing Hydrant Assembly	American Darling Model B-84-B or Approved Equal
Bolted Cast Couplings	Smith & Blair or Approved Equal
Brass Nipples and Pipe	State Origin
Brass Service Saddles	Mueller, Ford or Approved Equal
Butterfly Valves (Class 150)	Mueller Lineseal III or Approved Equal
Butterfly Valves (Class 250)	Mueller Lineseal XP or Approved Equal
Casing Spacers	State Origin
Cooper Tracing Wire 14 AWG - Solid	State Origin
Tracer Wire Connectors	Waterproof Connectors Dryconn or Approved Equal
Customer Individual Pressure Reducing Valve	Watts N55BUM1 or Approved Equal
Customer Meter	Neptune radio read equipment Model T-10 for 5/8" service
Customer Meter Box	18" x 24" White Smooth PVC MB-5
Customer Meter Box Cover	18" round cast iron flat with 2" lip or "legs" and hole for automatic meter read antenna. Sigma LC-218T or Approved Equal
Customer Meter Setter	5/8" x 5/8" Mueller, Ford or Approved Equal
DI and Cast Iron Full Body Tapping Sleeves	Mueller or Approved Equal
DI Double Strap Service Saddles	Mueller, Ford or Approved Equal
DI Pipe Class 350	Griffin, Clow, US Pipe, American DI Pipe or Approved Equal
Full Circle Repair Clamps (all stainless steel)	Mueller, Smith & Blair, Romac, or Approved Equal
Galvanized Compression Couplings	Smith & Blair or Approved Equal
Gate Valves	Mueller Resilient Seat or Approved Equal
HDPE Pipe	Flying W, WL Plastics or Approved Equal
Main Line Pressure Reducing Valve Strainer	Bermad Waterworks, or Approved Equal Mueller, or Approved Equal
Manhole Ring and Cover	J. R. Hoe & Sons or Approved Equal
MJ Fittings Compact/Full Body MJ Packs	McWayne (Tyler/Union, Clow), Griffin, US Pipe, American DI Pipe or Approved Equal

MATERIAL/ITEM	APPROVED MANUFACTURER
Precast Concrete Manholes	Cloud, Sherman-Dixie or Approved Equal
PVC Couplings	JM Manufacturing, Harrington, Multi-Fittings or Approved Equal
PVC Pipe Class 200, 250 or C900	Diamond, JM Manufacturing, Vulcon, Freedom, ETI, National, Pioneer or Approved Equal
Restraint Joint Collar Fittings	Mueller or Approved Equal
Service Tubing – Polyethylene Tubing (CTS Service Tubing)	Domestic – ¾" and 1" Endot EndoPure, SDR 9, 200 psi, blue in color or Approved Equal

SECTION 01610

TRANSPORTATION AND HANDLING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Handling and Distribution:

1. The Contractor shall handle, haul, and distribute all materials and all surplus materials on the different portions of the work, as necessary or required; shall provide suitable and adequate storage room for materials and equipment during the progress of the work, and be responsible for the protection, loss of, or damage to materials and equipment furnished by him, until the final completion and acceptance of the work.

2. Storage and demurrage charges by transportation companies and vendors shall be borne by the Contractor.

B. Storage of Materials and Equipment: All excavated materials and equipment to be incorporated in the work shall be placed so as not to injure any part of the work or the existing facilities and so that free access can be had at all times to all parts of the work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

- END OF SECTION -

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Liquidated Damages: General Provisions-11.20. CHARGES FOR DELAY CAUSED BY THE CONTRACTOR

B. Cleaning: Section 01710.

C. Project Record Documents: Section 01720.

1.02 SUBSTANTIAL COMPLETION

A. Contractor:

1. Submit written certification to Engineer that project is substantially complete.

2. Submit list of major items to be completed or corrected.

B. Engineer will make an inspection within seven days after receipt of certification, together with Owner's Representative.

C. Should Engineer consider that work is substantially complete:

1. Contractor shall prepare, and submit to Engineer, a list of items to be completed or corrected, as determined by the inspection.

2. Engineer will prepare and issue a Certificate of Substantial Completion, containing:

a. Date of Substantial Completion.

b. Contractor's list of items to be completed or corrected, verified and amended by Engineer.

c. The time within which Contractor shall complete or correct work of listed items.

d. Time and date Owner will assume possession of work or designated portion thereof.

e. Responsibilities of Owner and Contractor for:

(1) Insurance
(2) Utilities
(3) Operation of mechanical, electrical and other systems.
(4) Maintenance and cleaning.
(5) Security

f. Signatures of:

(1) Engineer.
(2) Contractor.
(3) Owner.

3. Owner occupancy of Project or Designated Portion of Project:

a. Contractor shall:

(1) Obtain certificate of occupancy.
(2) Perform final cleaning in accordance with Section 01710.

b. Owner will occupy Project, under provisions stated in Certificate of Substantial Completion.

4. Contractor shall complete work listed for completion or correction, within designated time.

D. Should Engineer consider that work is not substantially complete.

1. He shall immediately notify Contractor, in writing, stating reasons.

2. Contractor shall complete work, and send second written notice to Engineer, certifying that Project, or designated portion of Project is substantially complete.

3. Engineer will reinspect work.

1.03 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Project has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in presence of Owner's Representative and are operational.

5. Project is completed and ready for final inspection.

B. Engineer will make final inspection within seven (7) days after receipt of certification.

C. Should Engineer consider that work is finally complete in accordance with requirements of Contract Documents, he shall request Contractor to make Project Closeout submittals.

D. Should Engineer consider that work is not finally complete:

1. He shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Engineer certifying that work is complete.

3. Engineer will reinspect work.

1.04 FINAL CLEAN UP

The Work will not be considered as completed and final payment made until all final clean up has been done by the Contractor in a manner satisfactory to the Engineer. See Section 01710 for detailed requirements.

1.05 CLOSEOUT SUBMITTALS

Project Record Documents: To requirements of Section 01720.

1.06 FINAL APPLICATION FOR PAYMENT

Contractor shall submit final applications in accordance with requirements of GENERAL PROVISIONS.

1.07 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue final certificate in accordance with provisions of GENERAL PROVISIONS.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment.

- END OF SECTION -

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. During its progress the work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

B. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes, structures, by work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall, upon completion of the work, be left in a clean and neat condition.

C. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organics in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

D. The Contractor shall thoroughly clean all materials and equipment installed by him and his subcontractors, and on completion of the work shall deliver it undamaged and in fresh and new appearing condition.

E. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition equal or better than that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

1.02 DESCRIPTION

A. Related Requirements Specified Elsewhere:

1. Project Closeout: Section 01700.

2. Cleaning for Specific Products or Work: Specification Section for that work.

B. On a continuous basis, maintain premises free from accumulations of waste, debris, and rubbish, caused by operations.

C. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave Project clean and ready for occupancy.

1.03 SAFETY REQUIREMENTS

A. Hazards Control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.

2. Prevent accumulation of wastes, which create hazardous conditions.

3. Provide adequate ventilation during use of volatile or noxious substances.

B. Conduct cleaning and disposal operations in compliance with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on Project site without written permission from the Owner.

2. Do not dispose of volatile wastes such as mineral spirits, oil, or fuel in open drainage ditches or storm or sanitary drains.

3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

A. Execute cleaning to ensure that grounds and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to minimize blowing dust.

C. At reasonable intervals during progress of Work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off construction site.

F. The Contractor shall thoroughly clean all materials and equipment installed.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion, conduct final inspection of project area(s).

C. Broom clean paved surfaces; rake clean other surfaces of grounds.

D. Maintain cleaning until Project, or portion thereof, is accepted by Owner.

- END OF SECTION -

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall obtain from the Engineer, one (1) set of prints of the Contract Drawings. These prints shall be kept and maintained in good condition at the project site and a qualified representative of the Contractor shall enter upon these prints, from day-to-day, the actual "as-built" record of the construction progress. Entries and notations shall be made in a neat and legible manner and these prints shall be delivered to the Engineer upon completion of the construction. APPROVAL FOR FINAL PAYMENT WILL BE CONTINGENT UPON COMPLIANCE WITH THIS PROVISION.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

A. Section 01300 - Submittals.

B. General Provisions

1.03 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to Contract

B. Store documents in approved location, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by Engineer and Owner.

1.04 MARKING DEVICES

Provide colored pencil or felt-tip marking pen for all marking.

1.05 RECORDING

A. Label each document "PROJECT RECORD" in 2-inch high printed letters.

B. Keep record documents current.

C. Do not permanently conceal any work until required information has been recorded.

D. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

3. Field changes of dimension and detail.

4. Changes made by Change Order or Field Order.

5. Details not on original Contract Drawings.

E. Specifications and Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Change Order or Field Order.

3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate Shop Drawings to record changes made after review.

1.06 SUBMITTAL

A. At completion of project, deliver record documents to Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.

2. Project Title and Number.

3. Contractor's Name and Address.

4. Title and Number of each Record Document.

5. Certification that each Document as Submitted is Complete and Accurate.

6. Signature of Contractor, or his authorized Representative.

- END OF SECTION -

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Compile product data and related information appropriate for Owner's maintenance and operation of equipment furnished under the contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in the maintenance and operation of equipment and systems as outlined herein and/or in other Divisions.

C. In addition to maintenance and operations data, the manufacturer's printed recommended installation practice shall also be included. If not part of the operations and maintenance manual, separate written installation instructions shall be provided, serving to assist the Contractor in equipment installation.

D. Related Requirements Specified Elsewhere:

1. Section 01300 - Submittals.
2. Section 01700 - Project Closeout.
3. Section 01720 - Project Record Documents.
4. Section 01740 - Warranties and Bonds.
5. General Provisions

1.02 MAINTENANCE AND OPERATIONS MANUAL

Every piece of equipment furnished and installed shall be provided with complete maintenance and operations manuals. These shall be detailed in instructions to the Owner's personnel. They shall be attractively bound for the Owner's records.

The manuals shall be submitted to the Engineer for review as to adequacy and completeness. Provide three (3) copies each.

1.03 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 x 11 in.
2. Paper: 20 pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings:

    a. Provide reinforced punched binder tab, bind with text.
    b. Fold large drawings to the size of the text pages where feasible.
    c. For all drawings included within manuals, furnish a 3 mil mylar copy in standard size drawings 36" x 24", 8" x 16" or 8-1/2" x 11".
    d. For flow or piping diagrams that cannot be detailed on the standard size drawings, a larger, appropriate size drawing may be submitted.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.

a. Provide typed description of product, and major component parts of equipment.
b. Provide indexed tabs.

6. Cover: Identify each volume with types or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

a. Title of Project.
b. Identity of separate structure as applicable.
c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality, durable and cleanable, 3-hole, 3" or 4" post type binders, with oil and moisture resistant hard covers.
2. When multiple binders are used, correlate the data into related consistent grouping.
3. Labeled on the front cover and side of each binder shall be the name of the Project, the Contract Number and Volume Number.

D. Digital Copy:

1. A digital copy of the initial O&M manual shall be provided on a portable solid state hard drive or “Thumb Drive”. The contractor may submit multiple O&M manuals on 1 hard drive for ease of review and storage.
2. A final copy of all O&M manuals shall be provided to the owner on a portable solid state hard drive along with two (2) hard copies.

1.04 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. Contractor, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to the content of the volume.
3. List, with each product, the name, address and telephone number of:

a. Subcontractor or installer.
b. Maintenance contractor, as appropriate.
c. Identify the area of responsibility of each.
d. Local source of supply for parts and replacement.

4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product. References to other sizes and types or models of similar equipment shall be deleted or lined out.
2. Annotate each sheet to:

a. Clearly identify the specific product or part installed.
b. Clearly identify the data applicable to the installation.
c. Provide a parts list for all new equipment items, with catalog numbers and other data necessary for ordering replacement parts.

d. Delete references to inapplicable information.

3. Clear and concise instructions for the operation, adjustment, lubrication, and other maintenance of the equipment including a lubrication chart.

C. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.
b. Control and flow diagrams.

2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
3. Do not use Project Record Documents as maintenance drawings.

D. Written text, as required to supplement product data for the particular installation:

1. Organize in a consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.

E. Copy of each warranty, bond and service contract issued: Provide information sheet for Owner's personnel.

1. Proper procedures in the event of failure.
2. Instances which might affect the validity of warranties or bonds.

F. These manuals shall be delivered to the Engineer at the time designated by the Engineer. The manuals must be approved by the Engineer before final payment on the equipment is made.

- END OF SECTION -

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Related requirements specified elsewhere:

1. Bid Bond: Instructions to Bidders.

2. Performance and Payment Bonds: General Provisions.

3. Guaranty: General Provisions.

4. General Warranty of Construction: General Provisions.

5. Project Closeout: Section 01700.

6. Warranties and Bonds required for specific products: As listed herein.

7. Provisions of Warranties and Bonds, Duration: Respective specification sections for particular products.

8. Operating and Maintenance Data: Section 01730.

1.02 SUBMITTALS REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Furnish two (2) original signed copies.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product, equipment or work item.

2. Firm name, address and telephone number.

3. Scope
4. Date of beginning of warranty, bond or service and maintenance contract.

5. Duration of warranty, bond or service and maintenance contract.

6. Provide information for Owner's personnel:

   a. Proper procedure in case of failure.

   b. Instances which might affect the validity of warranty or bond.

7. Contractor name, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 in. x 11 in., punch sheets for 3-ring binder: Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:

   a. Title of Project.

   b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction: Submit documents within 10 days after inspection and acceptance.

B. Otherwise, make submittals within 10 days after date of substantial completion, prior to final request for payment.

C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing the date of acceptance as the start of the warranty period.

1.05 SUBMITTALS REQUIRED

Submit warranties, bonds, service and maintenance contracts as specified in the respective sections of the Specifications.

- END OF SECTION -

SECTION 02110

SITE CLEARING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Clear site within construction limits of plant life.

B. Remove grass and topsoil in area of access road and foundation.

C. Remove root system of trees and shrubs.

D. Remove surface debris

1.02 RELATED WORK

A. Section 02211 - Rough Grading.

B. Section 02222 - Excavation.

C. Section 02228 - Rock Removal

1.03 REGULATORY REQUIREMENTS

Conform to applicable local codes and ordinances for disposal of debris.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 CLEARING

A. Clear areas required for access to site and execution of work.

B. Remove trees, shrubs, brush, and other vegetable matter such as snags, bark, and refuse.

3.02 PROTECTION

The Contractor shall not cut or injure any trees or other vegetation outside the easement lines and outside the areas to be cleared, as indicated on the Drawings, without written permission from the Engineer. The Contractor shall be responsible for all damage done outside these lines.

3.03 GRUBBING

From areas to be grubbed, the Contractor shall remove completely all stumps, remove to a depth of at least 24 inches below subgrade elevation all roots larger than 1 1/2 in. in diameter, and remove to a depth of 12 in. all roots larger than 1/2 in. in diameter. Such depths shall be measured from the existing ground surface, the proposed finished grade or subgrade, whichever is lower.

3.04 STRIPPING

All stumps, roots, foreign matter, topsoil, loam, and unsuitable earth shall be stripped from the ground surface. The topsoil and loam shall be utilized insofar as possible, for finished surfacing. Loam shall not be taken from the site.

3.05 DISPOSAL

A. All material resulting from clearing and grubbing and not scheduled for reuse or stockpiling shall become the property of the Contractor and shall be suitably disposed of off site, unless otherwise directed by the Engineer, in accordance with all applicable laws, ordinances, rules and regulations.

B. Such disposal shall be performed as promptly as possible after removal of the material and shall not be left until the final period of cleaning up.

3.06 FENCES

Wherever fences need to be removed to provide access to the work or are damaged during the progress of work, they shall be restored or repaired to as good a condition as existed prior to construction at the Contractor's expense.

- END OF SECTION -

SECTION 02211

ROUGH GRADING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Remove topsoil and stockpile for later reuse.

B. Excavate subsoil and stockpile for later reuse as directed in Section 022110, Backfilling and Embankments.

C. Grade and rough contour site.

1.02 RELATED WORK

A. Section 02220 – Earthwork.

B. Section 02222 - Excavation.

C. Section 02228 - Rock Removal.

1.03 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01720.

B. Accurately record location of utilities remaining, rerouted utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 PROTECTION

A. Protect trees and other features remaining as portion of final landscaping.

B. Protect bench marks, existing structures, fences, roads, sidewalks and other features not designated for demolition.

C. Protect above or below grade utilities which are to remain.

D. Contractor shall be responsible for repairing any damage to those items not designated for demolition or removal in a manner satisfactory to the Owner at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Excavated material, graded free of roots, rocks larger than one inch, subsoil, debris, and large weeds.

B. Subsoil: Excavated material, graded free of lumps larger than 12 inches, rocks larger than 12 inches, and debris.

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known below grade utilities. Stake and flag locations.

C. Identify and flag above grade utilities.

D. Maintain and protect existing utilities remaining which pass through work area.

E. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Engineer.

3.02 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, and stockpile in area designated on site by the Engineer.

B. Do not excavate wet topsoil.

C. Stockpile topsoil to depth not exceeding 8 feet.

3.03 SUBSOIL EXCAVATION

A. Excavate subsoil from indicated areas and stockpile in area designated on site. Excess subsoil may be reused according to Section 02220, Backfilling.

B. Do not excavate wet subsoil.

C. Stockpile subsoil to depth not exceeding 8 feet.

D. When excavation through roots is necessary, perform work by hand and cut roots with a sharp axe.

3.04 TOLERANCES

Top Surface of Subgrade: Plus or minus three inches.

- END OF SECTION -

SECTION 02220

DEMOLITION & SALVAGE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for demolition as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 02300

1.03 PROCEDURE

A. The procedures proposed for the accomplishment of salvage and demolition work shall be submitted for review. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

B. It is the responsibility of the Contractor to visit the site to familiarize himself with the amount of Work that is included under this Section.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 DUST CONTROL

A. The amount of dust resulting from the demolition shall be controlled to prevent the spread of dust to occupied portions of the plant and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

3.02 DISCONNECTION OF UTILITY SERVICES

A. Utilities shall be disconnected at the points indicated by the Owner or Engineer and left in a safe condition.

3.03 BURNING

A. The use of burning at the project site for the disposal of refuse and debris will not be permitted, unless authorized in writing by the Owner.

3.04 PROTECTION OF EXISTING WORK

A. Existing work to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to match existing work.

3.05 BACKFILL OF STRUCTURES

A. The portion of the demolished structures remaining below grade shall be backfilled with concrete, masonry, etc., from the demolition or any backfill material which is acceptable to the Engineer. The top two (2) feet of the backfill shall be made up of topsoil and graded to match the existing ground. It shall be free of any of the demolition material. The entire backfill shall be compacted in such a manner as to prevent settlement. All existing demolished basins shall have some method of positive drainage thru the bottom slab as approved by the Engineer.

B. It is the responsibility of the Contractor to dispose of all excess demolition material from the site as soon as practicable.

3.06 SALVAGE MATERIAL

A. All equipment, pumps, controls, valves, piping, etc., is the property of the Owner and care shall be taken in its removal so not to damage it in any way. Such salvage material shall be removed and delivered to the Owner to a site designated by him. The Owner has the right to refuse any salvage material, and in such cases it is the responsibility of the Contractor to dispose of the unwanted material.

END OF SECTION

SECTION 02222

EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Structure excavation.

B. Shoring excavations.

1.02 RELATED WORK

A. Section 01450 - Quality Control.

B. Section 02228 - Rock Removal.

C. Section 02211 - Rough Grading.

D. Section 02226 – Trenching, Backfilling and Embankments.

1.03 REGULATORY REQUIREMENTS

A. Protect excavations by shoring, bracing, sheet piling, underpining, or other methods required to prevent cave-in or loose soil from falling into excavation.

B. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

C. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

E. Grade excavation top perimeter to prevent surface water run-off into excavation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Subsoil: Excavated material, graded free of lumps larger than 12 inches, rocks larger than 12 inches, and debris.

B. # 57's or # 9's: Mineral aggregate graded 1/4 inch to 5/8 inch, free of soil, subsoil, clay, shale, or foreign matter.

PART 3 – EXECUTION

3.01 PREPARATION

Identify required liens, levels, contours, and datum.

3.02 EXCAVATION

A. Excavate subsoil required for structure foundations, construction operations, and other work. All excavation shall be unclassified excavation.

B. Contractor is responsible to adequately brace open cuts and protect workmen and equipment from cave-in.

C. Remove lumped subsoil, boulders, and rock up to 1/3 cu. yd., measured by volume. Remove larger material under Section 02228.

D. Correct unauthorized excavation at no cost to Owner.

E. Fill over-excavated areas under structure bearing surfaces in accordance with direction by Engineer.

F. Stockpile excavated material in area designated on site.

3.03 FIELD QUALITY CONTROL

Provide for visual inspection of rock surfaces under provisions of Section 01450.

- END OF SECTION -

SECTION 02226

TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes excavation and backfill as required for pipe installation or other construction in the trench, and removal and disposal of water, in accordance with the applicable provisions of the Section entitled "Earthwork" unless modified herein.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXCAVATION

A. The trench excavation shall be located as shown on the Contract Drawings or as specified. Under ordinary conditions, excavation shall be by open cut from the ground surface. Where the depth of trench and soil conditions permit, tunneling may be required beneath cross walks, curbs, gutters, pavements, trees, driveways, railroad tracks and other surface structures. No additional compensation will be allowed for such tunneling over the price bid for open cut excavation of equivalent depths below the ground surface unless such tunnel excavation is specifically provided for in the Contract Documents.

B. Trenches shall be excavated to maintain the depths as shown on the Contract Drawings or as specified for the type of pipe to be installed.

C. The alignment and depth shall be determined and maintained by the use of a string line installed on batter boards above the trench, a double string line installed along side of the trench or a laser beam system.

D. The minimum width of trench excavation shall be 6-inches on each side of the pipe hub for 21-inch diameter pipe and smaller and 12-inches on each side of the pipe hub for 24-inch diameter pipe and larger.

E. Trenches shall not be opened for more than 300 feet in advance of pipe installation nor left unfilled for more than 100 feet in the rear of the installed pipe when work is in progress without the consent of the Engineer. Open trenches shall be protected and barricaded as required.

F. Bridging across open trenches shall be constructed and maintained where required.

3.02 SUBGRADE PREPARATION FOR PIPE

A. Where pipe is to be laid on undisturbed bottom of excavated trench, mechanical excavation shall not extend lower than the finished subgrade elevation at any point.

B. Where pipe is to be laid on special granular material the excavation below subgrade shall be to the depth specified or directed. The excavation below subgrade shall be refilled with

special granular material as specified or directed, shall be deposited in layers not to exceed 6 inches and shall be thoroughly compacted prior to the preparation of pipe subgrade.

C. The subgrade shall be prepared by shaping with hand tools to the contour of the pipe barrel to allow for uniform and continuous bearing and support on solid undisturbed ground or embedment for the entire length of the pipe.

D. Pipe subgrade preparation shall be performed immediately prior to installing the pipe in the trench. Where bell holes are required they shall be made after the subgrade preparation is complete and shall be only of sufficient length to prevent any part of the bell from becoming in contact with the trench bottom and allowing space for joint assembly.

3.03 STORAGE OF MATERIALS

A. Traffic shall be maintained at all times in accordance with the applicable Highway Permits. Where no Highway Permit is required at least one-half of the street must be kept open for traffic.

B. Where conditions do not permit storage of materials adjacent to the trench, the material excavated from a length as may be required, shall be removed by the Contractor, at his cost and expense, as soon as excavated. The material subsequently excavated shall be used to refill the trench where the pipe had been built, provided it be of suitable character. The excess material shall be removed to locations selected and obtained by the Contractor.

1. The Contractor shall, at his cost and expense, bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches.

C. If directed by the Engineer, the Contractor shall refill trenches with select fill or other suitable materials and excess excavated materials shall be disposed of as spoil.

3.04 REMOVAL OF WATER AND DRAINAGE

A. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the trench, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work.

B. The removal of water shall be in accordance with the Section entitled "Earthwork".

3.05 PIPE EMBEDMENT

A. All pipe shall be protected from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in suitable pipe embedment material. To ensure adequate lateral and vertical stability of the installed pipe during pipe jointing and embedment operations, a sufficient amount of the pipe embedment material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly compacted on each side, and back of the bell, of each pipe as laid.

B. Concrete cradle and encasement of the class specified shall be installed where and as shown on the Contract Drawings or ordered by the Engineer. Before any concrete is placed, the pipe shall be securely blocked and braced to prevent movement or flotation. The concrete cradle or encasement shall extend the full width of the trench as excavated unless otherwise authorized by the Engineer. Where concrete is to be placed in a sheeted trench it shall be poured directly against sheeting to be left in place or against a bond-breaker if the sheeting is to be removed.

C. Embedment materials placed above the centerline of the pipe or above the concrete cradle to a depth of 12 inches above the top of the pipe barrel shall be deposited in such manner as to not damage the pipe. Compaction shall be as required for the type of embedment being installed.

3.06 BACKFILL ABOVE EMBEDMENT

A. The remaining portion of the pipe trench above the embedment shall be refilled with suitable materials compacted as specified.

1. Where trenches are within the ditch-to-ditch limits of any street or road or within a driveway or sidewalk, or shall be under a structure, the trench shall be refilled in horizontal layers not more than 8 inches in thickness, and compacted to obtain 95% maximum density, and determined as set forth in the Section entitled "Earthwork".

2. Where trenches are in open fields or unimproved areas outside of the ditch limits of roads, the backfilling may be by placing the material in the trench and mounding the surface.

3. Hand tamping shall be required around buried utility lines or other subsurface features that could be damaged by mechanical compaction equipment.

B. Backfilling of trenches beneath, across or adjacent to drainage ditches and water courses shall be done in such a manner that water will not accumulate in unfilled or partially filled trenches and the backfill shall be protected from surface erosion by adequate means.

1. Where trenches cross waterways, the backfill surface exposed on the bottom and slopes thereof shall be protected by means of stone or concrete rip-rap or pavement.

C. All settlement of the backfill shall be refilled and compacted as it occurs.

D. Temporary pavement shall be placed as specified in the Section entitled "Restoration of Surfaces".

-END OF SECTION-

SECTION 02228

ROCK REMOVAL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes removal to the widths and depths shown on the Contract Drawings or as directed by the Engineer, including the loosening, removing, transporting, storing and disposal of all materials requiring blasting, barring, or wedging for removal from their original beds, and backfill of rock excavations with acceptable materials

B. Use of explosives for rock removal shall be used only with prior permission from both the Engineer and Owner. See section 01120 for additional information.

C. Rock removal is part of and incidental to unclassified excavation. No separate payment shall be made for rock removal.

1.02 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall be submitted:

1. Before any blasting operations begin the Contractor shall obtain all permits and licenses required.

1.03 DEFINITIONS

A. Rock

1. All pieces of ledge or bedrock, boulders or masonry larger than one-half cubic yard in volume.
2. Any material requiring blasting, barring, or wedging for removal from its original bed.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 BLASTING (Use of explosives for rock removal shall be used only with prior permission from both the Engineer and Owner.)

A. General

1. Handling of explosives and blasting shall be done only by experienced persons.
2. Handling and blasting shall be in accordance with all Federal, State and local laws, rules and regulations relating to the possession, handling, storage and transportation and use of explosives.
3. All blasts in open cut shall be properly covered and protected with approved blasting mats.

4. Charges shall be of such size that the excavation will not be unduly large and shall be so arranged and timed that adjacent rock, upon or against which pipelines or structures are to be built, will not be shattered.
5. Blasting will not be permitted within 25 feet of pipelines or structures.
6. All existing pipes or structures exposed during excavation shall be adequately protected from damage before proceeding with the blasting.
7. NFPA 495 - Code for Manufacture, Transportation, Storage and Use of Explosive Materials.
8. Commonwealth of Kentucky Department of Mines and Minerals, Laws and Regulations Governing Explosives and Blasting.

B. Repair of Damages Due to Blasting

1. Any injury or damage to the work or to existing pipes or structures shall be repaired or rebuilt by the Contractor at his expense.
2. Whenever blasting may damage adjacent rock, pipes or structures, blasting shall be discontinued and the rock removed by drilling, barring, wedging or other methods.

C. Explosives

1. At no time shall an excessive amount of explosives be kept at the site of the work. Such explosives shall be stored, handled and used in conformity with all applicable laws and regulations.
2. Accurate daily records shall be kept showing the amounts of explosives on hand, both at the site and at any storage magazine, the quantities received and issued, and the purpose for which issued.
3. The Contractor shall be responsible for any damage or injury to any persons, property or structures as a result of his handling, storage or use of explosives.

D. Rock Clearance in Trenches

1. Ledge rock, boulders and large stones shall be removed from the sides and bottom of the trench to provide clearance for the specified embedment of each pipe section, joint or appurtenance; but in no instance shall the clearance be less than 6 inches. Additional clearance at the pipe bell or joint shall be provided to allow for the proper make-up of the joint.
2. At the transition from an earth bottom to a rock bottom the minimum bottom clearance shall be 12 inches for a distance of not less than 5 feet.

E. Rock Clearance at Structures

1. Concrete for structures shall be placed directly on the rock and the excavation shall be only to the elevations and grades shown on the Contract Drawings.

3.02 EXCAVATION AND BACKFILL

A. Rock removal and backfilling shall be performed in accordance with the applicable provisions of the Section entitled "Earthwork".

B. The rock excavated which cannot be incorporated into the backfill material, as specified, shall be disposed of as spoil and shall be replaced with the quantity of acceptable material required for backfilling.

-END OF SECTION-

SECTION 02255

CRUSHED STONE AND DENSE GRADED AGGREGATE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install crushed stone for miscellaneous uses as shown on the Drawings, as called for in the Specifications.

B. Sizes, types, and quality of crushed stone are specified in this Section, but its use for replacement of unsuitable material, pavement base, and similar uses is specified in detail elsewhere in the Specifications. The Engineer may order the use of crushed stone for purposes other than those specified in other Sections, if, in his opinion, such use is advisable. Payment for same will be subject to negotiation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. When referred to in these Specifications, crushed stone shall be Number 57 graded in accordance with the Kentucky Department of Highways, Standard Specifications, latest edition, unless otherwise noted.

B. When referred to in these Specifications, dense graded aggregate (DGA) shall be crushed stone classified by the Kentucky Department of Highways, Standard Specifications, latest edition, and conforming to the following requirements:

Sieve Size	Percent Passing
1 Inch	100
3/4 Inch	70 - 100
1/2 Inch	50 - 80
#4	30 - 65
#10	17 - 50
#40	8 - 30
#200	2 - 10

PART 3 - EXECUTION

3.01 INSTALLATION

A. Crushed stone shall be placed and compacted in accordance with the Kentucky Department of Highways, Standard Specifications.

B. Crushed stone shall be placed in those areas as shown on the Drawings.

-- END OF SECTION --

SECTION 02260

POLYETHYLENE WRAP

PART 1: GENERAL

1.01 SECTION INCLUDES

A. The minimum requirements for polyethylene wrap to be used for external corrosion protection of buried ductile iron pipe, fittings, and appurtenances and for cast iron and ductile iron fittings on PVC pipe, and for barriervalves.

1.02 SUBMITTALS

A. Submit product data for proposed film and tape for approval.

B. Polyethylene wrap shall be installed in accordance with the current edition. of AWWA Standard Specification C105 (ANSI A21.5) for American National Standard for Polyethylene Encasement, unless otherwise specified herein.

1.03 MEASURE AND PAYMENT

A. No separate payment will be made for polyethylene wrap.

B. Include cost of polyethylene wrap in the unit price for pipes and fittings to be wrapped.

PART 2: PRODUCTS

2.01 MATERIALS POLYETHYLENE WRAP

A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays, or defects; conforming with requirements of AWWAC105, 2.5 to 3 percent carbon blackcontent, either low or high density:

1. Low-density polyethylene film shall be manufactured from virgin polyethylene material conforming to the following requirements of ASTM D4976.

2. High-density, cross laminated polyethylene film shall be manufactured from virgin polyethylene material conforming to the following requirements of ASTM D4976.

3. All material supplied shall be free from defects in material and workmanship and shall meet standards as stated in this specification.

4. All polyethylene wrap shall be linear low density, 8 mil thick, Tube-Type.

5. Wrap shall be furnished in rolls appropriate to the project (no scrap pieces), non-perforated.

6. Wrap shall be tinted PMS color 299-C or approved tinted blue color.

7. Product shall be in conformance with the latest edition of AWWA Standard C105/A21.5.

8. Film shall be manufactured of virgin polyethylene materials.

9. A certificate of compliance to all AWWA C105/A21.5 requirements shall be provided by the manufacturer.

10. Approved manufacturers are Hamilton Plastics, Christy's, Champion Plastics, and AA Thread.

2.02 POLYETHYLENE TAPE

A. All material supplied shall be free from defects in material and workmanship and shall meet standards as stated in this specification.

B. The material shall have a polyethylene film backing with the following performance characteristics.
1. Minimum thickness shall be 7 mils.

2. Minimum tensile strength shall be 20 lbs/inch per ASTM D-1000.

3. Adhesion to steel shall be a minimum of 25 oz/inch per PSTC-101.

4. Adhesion to backing shall be a minimum of 25 oz/inch per PSTC-101.

5. Minimum operating temperature shall be no greater than 40 degrees Fahenheit.

6. Maximum operating temperature shall be no less than 180 degrees Farenheit.

7. Provide minimum 2-inch-wide (3-inch typical), plastic-backed, adhesive tape.

8. Tape shall be Polyken 809 as manufactured by Berry Global Inc. or equal.

PART 3 : EXECUTION

3.01 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fit polyethylene film to contour of pipe to affect snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

3.02 INSTALLATION

A. Tubular Type (Method A):

1. Cut polyethylene tube to length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.

2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points.

4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

B. Tubular Type (Method B):

1. Cut polyethylene tube to length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points, secure ends.

2. Before making up joint, slip 3-foot length of polyethylene tube o ver end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3 foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least I foot; make each end snug and secure.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Sheet Type:

1. Cut polyethylene sheet to length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and makeup pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

D. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe- shaped appurtenances with polyethylene in same manner as pipe.

E. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

F. Openings in Encasement: Create openings for branches, service taps, blow- offs, air valves, and similar appurtenances by making X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with resulting damaged areas being repaired as specified.

G. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene -wrapped pipe joins adjacent

pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.

H. Ductile iron pipe shall not be wrapped for more than 5 days in advance of placement into the trench. Pipe to be wrapped shall include ductile iron wrapping. And ductile iron restrained-joint pipe and iron fittings. For any pipe that is wrapped prior to installation, Contractor shall use a method to lift and carry the pipe, such as canvas/nylon strapping, that will prevent damage to the wrapping.

I. Odd shaped appurtenances such as valves, tees, fittings, and other ferrous metal pipeline appurtenances shall be wrapped by using a flat sheet of polyethylene. Wrapping shall be done by placing the sheet under the appurtenances and bringing it up around the item to be wrapped.
Seams will be made by bringing the edges together, folding twice, and taping down. Each appurtenance shall receive two separate polyethylene wraps as described above.

3.03 REPAIRS

A. Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

B. Care shall be taken when backfilling to prevent damage to the polyethylene wrapping. Sections of wrapping having cuts, tears, punctures, or other damage shall be repaired or replaced.

END OF SECTION

SECTION 02270

SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall do all work and take all measures necessary to control soil erosion resulting from construction operations, shall prevent the flow of sediment from the construction site, and shall contain construction materials (including excavation and backfill) within his protected working area to prevent damage to adjacent property.

B. The Contractor shall not employ any construction method that violates a rule, regulation, guideline, or procedure established by Federal, State, or local agencies having jurisdiction over the environmental effects of construction. The Contractor shall be responsible for obtaining all associated permits.

C. Pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage, and other harmful waste shall not be discharged into or alongside of any body of water or into natural or man-made channels leading thereto.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Temporary Slope Protection and Erosion Control:

Bales may be hay or straw and shall be reasonably clean and free of noxious weeds and deleterious materials. Filter fabric for sediment traps shall be of suitable materials acceptable to the Engineer.

B. Permanent Slope Protection and Erosion Control:

On slopes 2H:1V and steeper and where shown on the drawings place Type A Dumped Rock Fill with a 24-inch minimum thickness over non-woven geotextile filter fabric.

PART 3 - EXECUTION

3.01 METHODS OF CONSTRUCTION

A. The Contractor shall use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of water diversion structures, diversion ditches and settling basins.

B. Construction operations shall be restricted to the areas of work indicated on the Drawings and to the area which must be entered for the construction of temporary or permanent facilities. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of the wetlands and adjacent watercourses. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.

C. Excavated soil material shall not be placed adjacent to the wetlands or watercourses in a manner that will cause it to be washed away by high water or runoff. Earth berms or diversions shall be constructed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by means acceptable to the Engineer. If for any reason construction materials are washed away during construction, the Contractor shall remove those materials from the fouled areas as directed by the Engineer.

D. For work within easements, all materials used in construction such as excavation, backfill, roadway, and pipe bedding and equipment shall be kept within the limits of the easements.

E. The Contractor shall not pump silt-laden water from trenches or other excavations into the wetlands, or adjacent watercourses. Instead, silt-laden water from his excavations shall be discharged within areas surrounded by baled hay or into sediment traps to ensure that only sediment-free water is returned to the watercourses. Damage to vegetation by excessive watering or silt accumulation in the discharge area shall be avoided.

F. Prohibited construction procedures include, but are not limited to, the following:

1. Dumping of spoil material into any streams, wetlands, surface waters, or unspecified locations.

2. Indiscriminate, arbitrary, or capricious operation of equipment in wetlands or surface waters.

3. Pumping of silt-laden water from trenches or excavations into surface waters, or wetlands.

4. Damaging vegetation adjacent to or outside of the construction area limits.

5. Disposal of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, wash water from concrete trucks or hydro seeders, or any other pollutant in wetlands, surface waters, or unspecified locations.

6. Permanent or unauthorized alteration of the flow line of any stream.

7. Open burning of debris from the construction work.

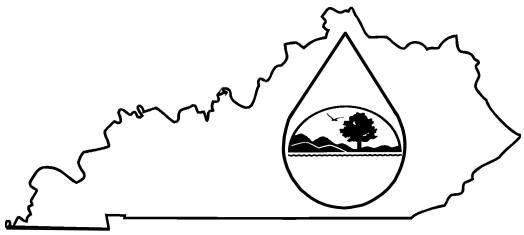
G. Any temporary working roadways required shall be clean fill approved by the Engineer. In the event fill is used, the Contractor shall take every precaution to prevent the fill from mixing with native materials of the site. All such foreign fill materials shall be removed from the site following construction.

3.02 EROSION CHECKS

The Contractor shall furnish and install baled hay or straw erosion checks in all locations indicated on the Drawings, surrounding the base of all deposits of stored excavated material outside of the disturbed area, and where indicated by the Engineer. Checks, where indicated on the Drawings, shall be installed immediately after the site is cleared and before trench excavation is begun at the location indicated. Checks located surrounding stored material shall be located approximately 6 ft. from that material. Bales shall be held in place with two 2 in. by 2 in. by 3 ft. wooden stakes. Each bale shall be butted tightly against the adjoining bale to preclude short circuiting of the erosion check.

- END OF SECTION -

KPDES FORM NOI-SW



Kentucky Pollutant Discharge Elimination System (KPDES)

Notice of Intent (NOI)
for Storm Water Discharges
Associated with Industrial Activity Under the KPDES General Permit

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a KPDES permit issued for storm water discharges associated with industrial activity. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit.

ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM (See Instructions on back)

I. Facility Operator Information

Name:		**Phone:**	
Address:		**Status of Owner/Operator:**	
City, State, Zip Code:			

II. Facility/Site Location Information

Name:			
Address:			
City, State, Zip Code:			
County:			
Site Latitude: (degrees/minutes/seconds)		**Site Longitude: (degrees/minutes/seconds)**	

III. Site Activity Information

MS4 Operator Name:							
Receiving Water Body:							
Are there existing quantitative data?	**Yes** ☐ **If Yes, submit with this form.** **No** ☐						
SIC or Designated Activity Code Primary		**2nd**		**3rd**		**4th**	
If this facility is a member of a Group Application, enter Group Application Number:							
If you have other existing KPDES Permits, enter Permit Numbers:							

IV. Additional Information Required FOR CONSTRUCTION ACTIVITIES ONLY

Project Start Date:		**Completion Date:**	
Estimated Area to be disturbed (in acres):			
Is the Storm Water Pollution Prevention Plan in Compliance with State and/or Local Sediment and Erosion Plans?		**Yes** ☐ **No** ☐	

V. Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed or Typed Name:			
Signature:		**Date:**	

Kentucky Pollutant Discharge Elimination System (KPDES)
Instructions
Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity
To Be Covered Under The KPDES General Permit

WHO MUST FILE A NOTICE OF INTENT (NOI) FORM

Federal law at 40 CFR Part 122 prohibits point source discharges of stormwater associated with industrial activity to a water body of the Commonwealth of Kentucky without a Kentucky Pollutant Discharge Elimination System (KPDES) permit. The operator of an industrial activity that has such a storm water discharge must submit a NOI to obtain coverage under the KPDES Storm Water General Permit. If you have questions about whether you need a permit under the KPDES Storm Water program, or if you need information as to whether a particular program is administered by the state agency, call the **Storm Water Contact, Industrial Section, Kentucky Division of Water at (502) 564-3410.**

WHERE TO FILE NOI FORM

NOIs must be sent to the following address:

Section Supervisor
Inventory & Data Management Section
KPDES Branch, Division of Water
Frankfort Office Park
14 Reilly Road
Frankfort, KY 40601

COMPLETING THE FORM

Type or print legibly in the appropriate areas only. If you have any questions regarding the completion of this form call the **Storm Water Contact, Industrial Section, at (502) 564-3410.**

SECTION I - FACILITY OPERATOR INFORMATION

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same as the name of the facility. The responsible party is the legal entity that controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Enter the appropriate letter to indicate the legal status of the operator of the facility.

F = Federal M = Public (other than federal or state)
S = State P = Private

SECTION II - FACILITY/SITE LOCATION INFORMATION

Enter the facility's or site's official or legal name and complete street address, including city, state, and ZIP code.

SECTION III - SITE ACTIVITY INFORMATION

If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g., municipality name, county name) and the receiving water of the discharge from the MS4. (A MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, borough, county, parish, district, association, or other public body which is designed or used for collecting or conveying storm water.)

If the facility discharges storm water directly to receiving water(s), enter the name of the receiving water.

Indicate whether or not the owner or operator of the facility has existing quantitative data that represent the characteristics and concentration of pollutants in storm water discharges. If data is available submit with this form.

List, in descending order of significance, up to four 4-digit standard industrial classification (SIC) codes that best describe the principal products or services provided at the facility or site identified in Section II of this application.

If the facility listed in Section II has participated in Part 1 of an approved storm water group application and a group number has been assigned, enter the group application number in the space provided.

If there are other KPDES permits presently issued for the facility or site listed in Section II, list the permit numbers.

SECTION IV - ADDITIONAL INFORMATION REQUIRED FOR CONSTRUCTION ACTIVITIES ONLY

Construction activities must complete Section IV in addition of Sections I through III. Only construction activities need to complete Section IV.

Enter the project start date and the estimated completion date for the entire development plan.

Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre).

Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, permits, or storm water management plans.

SECTION V - CERTIFICATION

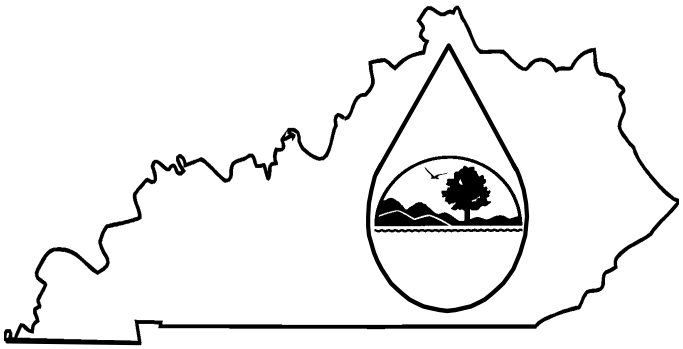
Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer,which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authroity to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

KPDES FORM NOT-SW



Kentucky Pollutant Discharge Elimination System (KPDES)

NOTICE OF TERMINATION (NOT)
of Coverage Under the KPDES General Permit for Storm Water Discharges Associated with Industrial Activity

Submission of this Notice of Termination constitutes notice that the party identified in Section II of this form is no longer authorized to discharge storm water associated with industrial activity under the KPDES program.

ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM.
(Please see instructions on back before completing this form.)

I. PERMIT INFORMATION
KPDES Storm Water General Permit Number:
Check here if you are no longer the Operator of the Facility: ☐
Check here if the Storm Water Discharge is Being Terminated: ☐
II. FACILITY OPERATOR INFORMATION
Name:
Address:
City/State/Zip Code:
Telephone Number:
III. FACILITY/SITE LOCATION INFORMATION
Name:
Address:
City/State/Zip Code:

Certification: I certify under penalty of law that all storm water discharges associated with industrial activity from the identified facility that are authorized by a KPDES general permit have been eliminated or that I am no longer the operator of the facility or construction site. I understand that by submitting this Notice of Termination, I am no longer authorized to discharge storm water associated with industrial activity under this general permit, and that discharging pollutants in storm water associated with industrial activity of waters of the Commonwealth is unlawful under the Clean Water Act and Kentucky Regulations where the discharge is not authorized by a KPDES permit. I also understand that the submittal of this Notice of Termination does not release an operator from liability for any violations of this permit or the Kentucky Revised Statutes.

NAME (Print or Type)	TITLE
SIGNATURE	DATE

INSTRUCTIONS
NOTICE OF TERMINATION (NOT) OF COVERAGE UNDER THE KPDES GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY

Who May File a Notice of Termination (NOT) Form
Permittees who are presently covered under the Kentucky Pollutant Discharge Elimination System (KPDES) General Permit for Storm Water Discharges Associated with Industrial Activity may submit a Notice of Termination (NOT) form when their facilities no longer have any storm water discharges associated with industrial activity as defined in the storm water regulations at 40 CFR 122.26 (b)(14), or when they are no longer the operator of the facilities.

For construction activities, elimination of all storm water discharges associated with industrial activity occurs when disturbed soils at the construction site have been finally stabilized and temporary erosion and sediment control measures have been removed or will be removed at an appropriate time, or that all storm water discharges associated with industrial activity from the construction site that are authorized by a KPDES general permit have otherwise been eliminated. Final stabilization means that all soil-disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70% of the cover for unpaved areas and areas not covered by permanent structures has been established, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles have been employed.

Where to File NOT Form
Send this form to the following address:

Section Supervisor
Inventory & Data Management Section
KPDES Branch, Division of Water
14 Reilly Road, Frankfort Office Park
Frankfort, KY 40601

Completing the Form
Type or print legibly in the appropriate areas and according to the instructions given for each section. If you have questions about this form, call the Storm Water Contact, Industrial Section, at (502) 564-3410.

Section I - Permit Information
Enter the existing KPDES Storm Water General Permit number assigned to the facility or site identified in Section III. If you do not know the permit number, **call the Storm Water Contact, Industrial Section at (502) 564-3410.**

Indicate your reason for submitting this Notice of Termination by checking the appropriate box:

If there has been a change of operator and you are no longer the operator of the facility or site identified in Section III, check the corresponding box.

If all storm water discharges at the facility or site identified in Section III have been terminated, check the corresponding box.

Section II - Facility Operator Information
Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same name as the facility. The operator of the facility is the legal entity which controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Section III - Facility/Site Location Information
Enter the facility's or site's official or legal name and complete address, including city, state and ZIP code. If the facility lacks a street address, indicate the state, the latitude and longitude of the facility to the nearest 15 seconds, or the quater, section, township, and range (to the nearest quarter section) of the approximate center of the site.

Section IV - Certification
Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, State, Federal, or other public facility: by either a principal executive

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Extent of earthwork is indicated on the Drawings.

1. Preparation of subgrade for pavements is included as part of this work.
2. Engineered fill for support of building or basin slabs is included as part of this work.
3. Backfilling of tanks, basins, basements and trenches within building line is included as part of this work.

B. Excavation for Mechanical/Electrical Work: Excavation and backfill required in conjunction with underground mechanical and electrical utilities, and buried mechanical and electrical appurtenances is included as work of this Section.

C. Definition: "Excavation" consists of removal of all material encountered to subgrade elevations and subsequent disposal or reuse of materials removed.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

1. American Society for Testing and Materials (ASTM)

a. A328 Specification for Steel Sheet Piling
b. D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3)
c. D1556 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
d. D1760 Specification for Pressure Treatment of Timber Products
e. D2922 Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. State and local code requirements shall control the disposal of trees and shrubs.

B. All burning shall be controlled by applicable local regulations.

C. EXCAVATION – Section 02222

D. TRENCHING, BACKFILLING, AND COMPACTING – Section 02226

E. ROCK REMOVAL – Section 02228

F. SLOPE PROTECTION – Section 02270

1.04 JOB CONDITIONS

A. Weather: Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain, snow, ice, drought or other adverse weather conditions.

B. Existing Utilities: Prior to commencement of work, the Contractor shall locate existing underground utilities in areas of the work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives: The Contractor (or any of his Subcontractors) shall not bring explosives onto site or use in work without prior written permission from the Owner. All activities involving explosives shall be in compliance with the rules and regulations of the State Department of Mines, and Minerals, Division of Explosives and Blasting. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.

   a. Operate warning lights as recommended by authorities having jurisdiction.
   b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Dust Control: Use all means necessary to control dust on or near the project site where such dust is caused by the Contractor's operations or directly results from conditions left by the Contractor.

1.05 UTILITY LINE ACTIVITIES COVERED UNDER NATIONWIDE PERMIT # 12

All activities involving utility line construction covered under NATIONWIDE PERMIT # 12 shall meet the following conditions:

A. The general Water Quality Certification is limited to the crossing of intermittent and perennial streams by utility lines.

B. The construction of permanent or temporary access roads will impact less than 300 linear feet of intermittent and perennial streams and less than one acre of jurisdictional wetlands.

C. Utility lines shall be located at least 50 feet away from a stream which appears as a blue line on a USGS 7 ½ minute topographic map except where the utility line alignment crosses the stream. Utility lines that cross streams shall be constructed by methods that maintain normal stream flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to re-entering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the utility line excavation shall not be allowed to enter the flowing portion of the stream.

D. The activities shall not result in any permanent changes in preconstruction elevation contours in waters or wetlands or stream dimension, pattern or profile.

E. Utility line construction projects through jurisdictional wetlands shall not result in

conversion of the area to non-wetland status.

F. Measures shall be taken to prevent or control spills of fuels, lubricants, or other toxic materials used in construction form entering the watercourse.

G. Removal of riparian vegetation in the utility line right-of-way shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures must be employed at all times during the project to prevent degradation of waters of the Commonwealth. Site regarding and reseeding will be accomplished with 14 days after disturbance.

H. To the maximum extent practicable, all in stream work under this certification shall be performed during low flow.

I. Heavy equipment, e.g. bulldozers, backhoes, draglines, etc., if required for this project, should not be used or operated within the stream channel. In those instances where such in stream work is unavoidable, then it shall be performed in such a manner and duration as to minimize turbidity and disturbance to substrates and bank or riparian vegetation.

J. Any fill shall be of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters and/or cause violations of water quality standards. If riprap is utilized, it is to be of such weight and size that bank stress or slump conditions will not be created because of its placement.

K. Removal of existing riparian vegetation should be restricted to the minimum necessary for project construction.

L. Should evidence of stream pollution or jurisdictional wetland impairment and/or violations of water quality standards occur as a result of this activity (either from a spill or other forms of water pollution), the Kentucky Division of Water shall be notified immediately by calling 800/928-2380.

1.06 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: The Owner shall engage the services of a qualified geotechnical engineering, inspection, and testing firm for quality control testing during earthwork operations.

1.07 SUBMITTALS

A. Test Reports - Excavating: Copies of all test reports and field reports shall be made available to the Owner and the Engineer.

B. The Contractor shall provide access to site areas, borrow pits and other areas for testing. The Contractor shall also indicate the need for tests to be performed. The Contractor may prepare any tests necessary for the conduct of his work.

1.08 DEFINITIONS

A. Excavation (or Trenching)

1. Grubbing, stripping, removing, storing and rehandling of all materials of every name and nature necessary to be removed for all purposes incidental to the construction and completion of all the work under construction.
2. All sheeting, sheetpiling, bracing and shoring, and the placing, driving, cutting off and removing of the same.
3. All diking, ditching, fluming, cofferdamming, pumping, bailing, draining, well pointing, or otherwise disposing of water.
4. The removing and disposing of all surplus materials from the excavations in the manner specified.
5. The maintenance, accommodation and protection of travel and the temporary paving of highways, roads and driveways.
6. The supporting and protecting of all tracks, rails, buildings, curbs, sidewalks, pavements, overhead wires, poles, trees, vines, shrubbery, pipes, sewers, conduits or other structures or property in the vicinity of the work, whether over- or underground or which appear within or adjacent to the excavations, and the restoration of the same in case of settlement or other injury.
7. All temporary bridging and fencing and the removing of same.

B. Earth

1. All materials such as sand, gravel, clay, loam, ashes, cinders, pavements, muck, roots or pieces of timber, soft or disintegrated rock, not requiring blasting, barring, or wedging from their original beds, and specifically excluding all ledge or bedrock and individual boulders or masonry larger than one-half cubic yard in volume.

C. Backfill

1. The refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.

D. Spoil

1. Surplus excavated materials not required or not suitable for backfills or embankments.

E. Embankments

1. Fills constructed above the original surface of the ground or such other elevation as specified or directed.

F. Limiting Subgrade

1. The underside of the pipe barrel for pipelines
2. The underside of footing lines for structures

G. Excavation Below Subgrade

1. Excavation below the limiting subgrades of structures or pipelines.

2. Where materials encountered at the limiting subgrades are not suitable for proper support of structures or pipelines, the Contractor shall excavate to such new lines and grades as required.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:

1. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, GC, SC, ML, and CL.
2. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups MH, CH, OL, OH and PT. The Contractor shall notify the Engineer if these soil materials are encountered.
3. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.
4. Drainage Fill: Washed, evenly graded mixture of crushed stone, or uncrushed gravel, with 100 percent passing a 1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.
5. Backfill and Fill Materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.

2.02 FILTER FABRIC

A. Material shall be non-woven polyester or polypropylene geotextile having an equivalent opening size no finer than U.S. Standard Sieve No. 200 and no coarser than a U.S. Standard Sieve No. 140.

B. An acceptable product is Typar 3601 manufactured by the Dupont Corporation. Other equivalent products shall be submitted to the Engineer for review and approval prior to usage.

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING

A. Work shall consist of cutting and removing designated trees, stumps, brush, logs, removal of fences, or other loose and projecting material. Unless otherwise specified, it shall also include the grubbing of stumps, roots, and other natural obstructions which, in the opinion of the Engineer, must be removed to execute properly the construction work and operate properly the facility upon the completion of construction.

B. Trees, bushes, and all natural vegetation shall only be removed with the approval of the Engineer. No cleared or grubbed materials shall be used in backfills or embankment fills. All stumps, roots, and other objectionable material shall be grubbed up so that no roots larger than 3 inches in diameter remain less than 18 inches below the ground surface. All holes and depressions left by grubbing operations shall be filled with suitable material and compacted to grade, as recommended in Paragraph 3.06.

C. Disposal shall be by burning or other methods satisfactory to the Engineer; however, burning will be permitted only when the Contractor has obtained written permission from the local regulatory agency.

D. The Contractor shall also remove from the site and satisfactorily dispose of all miscellaneous rubbish including, but not limited to, masonry, scrap metal, rock, pavement, etc., that is under the fill or to be removed as shown on the Drawings, specified herein, or directed by the Engineer.

E. Existing improvements, adjacent property, utility and other facilities, and trees, plants, and brush that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.

F. Trees and shrubs, designated to remain or that are beyond the clearing and grubbing limit, which are injured or damaged during construction operations shall be treated or replaced at the Contractor's expense by experienced tree surgery personnel.

3.02 EROSION CONTROL

A. Temporary measures shall be applied throughout the construction period to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, silt barriers, gravel or crushed stone, mulch, slope drains and other methods.

B. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

C. Refer to Section 02371, Erosion and Sedimentation Control for requirements.

3.03 EXCAVATION

A. Excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required for the work. All excavation of materials shall be included in the lump sum portion of the work and will be UNCLASSIFIED AND NO ADDITIONAL PAYMENT WILL BE MADE REGARDLESS OF TYPE OF MATERIAL ENCOUNTERED.

B. All excavated materials that meet the requirements for fill, subgrades or backfill shall be stockpiled within the site for use as fill or backfill, or for providing the final site grades. Where practicable, suitable excavated material shall be transported directly to any place in the fill areas within the limits of the work. All excavated materials that are not suitable for fill, and any surplus of excavated material that is not required for fill shall be disposed of by the Contractor.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the excavation is backfilled or the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. Excavations for concrete structural slabs on grade and footings shall extend eighteen (18) inches below the indicated bottom of slabs. The over-excavation shall be backfilled with 6 inches, compacted thickness, of compacted dense-graded aggregate. The remaining twelve (12) inches of over-excavation shall be backfilled with compacted, porous aggregate fill. This porous fill layer shall extend beyond the limits of the concrete slab a minimum of twelve (12) inches on all sides as indicated on the Drawings. The porous fill shall be crushed stone or gravel and shall have the following U.S. Standard Sieve gradation:

Sieve	1-1/2	1	3/4	1/2	3/8
% Passing	Min 100	95±5	58±17	Max 15	Max 5

E. Excavations for the construction shall be carefully made to the depths required. Bottoms for footings and grade beams shall be level, clean and clear of loose material, the lower sections true to size. Bottoms of footings and grade beams, in all locations, shall be at a minimum depth of 30 inches below adjacent exterior finished grade or 30 inches below adjacent existing grade, whichever is lower, **whether so indicated or not.** Footings and grade beam bottoms shall be inspected by the Engineer before any concrete is placed thereon.

F. In excavations for structures where, in the opinion of the Engineer, the ground is loose, soft, spongy, or otherwise unsuitable for the contemplated foundation, the Contractor shall remove such unsuitable material and replace it with suitable material properly compacted.

G. Sheeting and shoring shall be provided as necessary for the protection of the work and for the safety of the personnel. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, will be subject to the review of the Engineer, but the Contractor shall be responsible for the adequacy of all sheeting, bracing and cofferdamming. All shoring, bracing and sheeting shall be removed as the excavations are backfilled in a manner such as to prevent injurious caving; or, if so directed by the Engineer, shall be left in place. Sheeting left in place shall be cut off 18 inches below the surface.

H. Excavation for structures which have been carried below the depths indicated without specific instructions shall be refilled to the proper grade with suitable material properly compacted, except that in excavation for columns, walls or footings, the concrete footings shall extend to this lower depth. All work of this nature shall be at the Contractor's expense.

3.04 REMOVAL OF WATER

A. General

1. The Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of pipes, structures, or other work.
2. Unless otherwise specified, all excavations which extend down to or below the static groundwater elevations shall be dewatered by lowering and maintaining the groundwater beneath such excavations at all times when work thereon is in progress, during subgrade preparation and the placing of the structure or pipe thereon.
3. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least 24 hours after placement, and no stream of water shall be allowed to flow over such work until such time as the Engineer may permit.

4. Where the presence of fine grained subsurface materials and a high groundwater table may cause the upward flow of water into the excavation with a resulting quick or unstable condition, the Contractor shall install and operate a well point system to prevent the upward flow of water during construction.
5. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be disposed of in a suitable manner without injury to adjacent property, the work under construction, or to pavements, roads, drives, and water courses. No water shall be discharged to sanitary sewers. Sanitary sewage shall be pumped to sanitary sewers or shall be disposed of by an approved method.
6. Any damage caused by or resulting from dewatering operations shall be the sole responsibility of the Contractor.

B. Work Included

1. The construction and removal of cofferdams, sheeting and bracing, and the furnishing of materials and labor necessary therefor.
2. The excavation and maintenance of ditches and sluiceways.
3. The furnishing and operation of pumps, well points, and appliances needed to maintain thorough drainage of the work in a satisfactory manner.

C. Well Point Systems

1. Installation

a. The well point system shall be designed and installed by or under the supervision of an organization whose principal business is well pointing and which has at least five consecutive years of similar experience and can furnish a representative list of satisfactory similar operations.
b. Well point headers, points and other pertinent equipment shall not be placed within the limits of the excavation in such a manner or location as to interfere with the laying of pipe or trenching operations or with the excavation and construction of other structures.
c. Detached observation wells of similar construction to the well points shall be installed at intervals of not less than 50 feet along the opposite side of the excavation from the header pipe and line of well points, to a depth of at least 5 feet below the proposed excavation. In addition, one well point in every 50 feet shall be fitted with a tee, plug and valve so that the well point can be converted for use as an observation well. Observation wells shall be not less than 1-½ inches in diameter.
d. Standby gasoline or diesel powered equipment shall be provided so that in the event of failure of the operating equipment, the standby equipment can be readily connected to the system. The standby equipment shall be maintained in good order and actuated regularly not less than twice a week.

2. Operation

a. Where well points are used, the groundwater shall be lowered and maintained continuously (day and night) at a level not less than 2 feet below the bottom of the excavation. Excavation will not be permitted at a level lower than 2 feet above the water level as indicated by the observation wells.

b. The effluent pumped from the well points shall be examined periodically by qualified personnel to determine if the system is operating satisfactorily without the removal of fines.

c. The water level shall not be permitted to rise until construction in the immediate area is completed and the excavation backfilled.

3.05 FILL

A. All existing fill below structures and paved areas must be stripped. The upper six (6) inches of the natural subgrade below shall be scarified and recompacted at optimum moisture to at least ninety-five percent (95%) of Standard Proctor Density ASTM D 698 (latest revision).

B. All vegetation, such as roots, brush, heavy sods, heavy growth of grass and all decayed vegetable matter, rubbish and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Existing fill from excavated areas on site shall be used as fill for open and/or planted areas. Additional fill stockpiled at the site can be used for structural fill if approved by the Engineer. Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the Engineer. All fill material shall be free from trash, roots and other organic material. The best material to be used in fills shall be reserved for backfilling pipe lines and for finishing and dressing the surface. Material larger than 3 inches maximum dimension shall not be permitted in the upper 6 inches of the fill area. Fill material shall be placed in successive layers and thoroughly tamped or rolled in a manner approved by the Engineer, each layer being moistened or dried such that the specified degree of compaction shall be obtained. No fill shall be placed or compacted in a frozen condition or on top of frozen material. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed and no compaction of fill will be permitted with free water on any point of the surface of the fill to be compacted.

C. Where concrete slabs are placed on earth, all loam and organic or other unsuitable material shall be removed. Where fill is required to raise the subgrade for concrete slabs to the elevations as indicated on the Drawings or as required by the Engineer, such fill shall consist of suitable material and shall be placed in layers. Each layer shall be moistened or dried such that the specified degree of compaction shall be obtained. All compaction shall be accomplished in a manner and with equipment as approved by the Engineer. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for adjacent fill.

3.06 BACKFILLING

A. After completion of footings, grade beams and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Material for backfilling shall be as specified for suitable material, placed and compacted as specified hereinafter. Backfill shall be placed in horizontal layers of the thickness specified and shall have a moisture content such that the required degree of compaction is obtained. Each layer shall be compacted by mechanical tampers or by other suitable equipment approved by the Engineer to the specified density. Special care shall be taken to prevent wedging action or eccentric loading upon or against the structure. Trucks and machinery used for grading shall not be allowed within 45 degrees above the bottom of the footings or grade beams.

B. The trenches shall be backfilled following visual inspection by the Engineer and prior to pressure testing. The trenches shall be carefully backfilled with the excavated materials approved for backfilling, or other suitable materials, free from large clods of earth or stones.

Each layer shall be compacted to a density at least equal to that of the surrounding earth and in such a manner as to permit the rolling and compaction of the filled trench with the adjoining earth to provide the required bearing value, so that paving, if required, can proceed immediately after backfilling is completed.

3.07 COMPACTION

A. Suitable material as hereinbefore specified shall be placed in maximum 8" horizontal layers. Compaction shall be performed by rolling with approved tamping rollers, pneumatic-tired rollers, three wheel power rollers or other approved equipment. The degree of compaction required is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D-698. Laboratory moisture density tests shall be performed on all fill material. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction. Compaction requirements shall be as specified below:

Fill Utilized For	Required Density (%)	Maximum Permissible Lift Thickness As Compacted, Inches
Backfill & Utility Trenches Under Foundations & Pavements	95-100	8
Backfill Around Structures	95-100	8
Field and Utility Trench Backfill Under Sidewalks and Open Areas	90-100	8

B. Field density tests shall be performed in sufficient number to insure the specified density is being obtained. Test each lift per 5,000 FT^2 with a minimum of two (2) tests per lift. Tests shall be in accordance with ASTM Standards D 1556 or D 2922/D 3017 and shall be performed as authorized by the Engineer. Testing/inspections shall be provided by the Owner. Contractor shall provide suitable notification for coordination of testing. Delays due to the lack of adequate advance notification shall be the responsibility of the Contractor.

3.08 SITE GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines:

1. All materials used for backfill around structures shall be of a quality acceptable to the Engineer and shall be free from large or frozen lumps, wood and other extraneous material. All spaces excavated and not occupied by footings, foundations, walls or other permanent work shall be refilled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement. In making the fills and terraces around the structures, the fill shall be placed in layers not exceeding 8-inches in depth and shall be kept smooth as the work progresses. Each layer of the fill shall be compacted. Sections of the fill immediately adjacent to buildings or structures shall be thoroughly compacted by means of mechanical tamping or hand tamping as may be required by the conditions encountered. All fills shall be placed so as to load structures symmetrically.

2. As set out hereinbefore, rough grading shall be held below finished grade and then the topsoil, which has been stockpiled, shall be evenly spread over the surface. The grading shall be brought to the levels shown on the Drawings. Final dressing shall be accomplished by hand work or machine work, or a combination of these methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than 2-inches in diameter. Excavated rock may be placed in the fills, but it shall be thoroughly covered. Rock placed in fills shall not be closer than 12-inches from finished grade.
3. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

    a. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not above or 1.0 inch below required subgrade elevation.
    b. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1.0 in. below required subgrade elevation.

C. Grading Surface of Fill Under Non-Structural Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 0.0 in. above or 1.0 in. below required subgrade elevation when tested with a 10-ft. straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or standard proctor density for each area classification.

E. Slope Protection and Erosion Control: Conform to the requirements of Section 02270 for permanent slope protection and erosion control.

3.09 TOPSOIL

A. Provide all labor, materials, equipment and services required for furnishing and placing topsoil. Samples of topsoil shall be submitted to the Engineer for review before topsoil is placed. The material shall be good quality loam and shall be fertile, friable, mellow; free from stones larger than one (1) inch, excessive gravel, junk metal, glass, wood, plastic articles, roots and shall have a liberal amount of organic matter. Light sand loam or heavy clay loam will not be acceptable.

B. The topsoil shall be 3 inches thick in all areas to be seeded. No topsoil shall be placed until the area to be covered is excavated or filled to the required grade. Imported backfill material will be stockpiled on site for structure backfilling and top soiling.

3.10 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction:

1. Allow the Geotechnical Engineer to inspect and report to the Engineer on findings and approve subgrades and fill layers before further construction work is performed.
2. Perform field density tests in accordance with ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2992 (nuclear density method), as applicable and at a frequency necessary to be reasonably assured that adequate compaction is achieved.

B. If in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense to the Owner.

3.11 MAINTENANCE

A. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

B. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.12 DISPOSAL OF EXCESS NON-ORGANIC SOIL AND ROCK

A. General: All excess excavated material shall become the property of the Contractor and shall be disposed by him outside the project limits. It is the Contractor's responsibility to locate a suitable waste area off-site, obtain necessary permits or use of the waste area and be in compliance with applicable laws and regulations.

END OF SECTION

SECTION 02360 – AGGREGATE PIER SOIL IMPROVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Aggregate Piers specified herein to provide soil reinforcement within the limits indicated on the project drawings to achieve the degree of improvement required to meet the performance criteria herein and as defined in the project drawings.

B. Scope of Work

1. The work shall consist of designing, furnishing, installing, monitoring and testing of the Aggregate Piers to meet the performance criteria presented in these specifications.
2. In connection with the Aggregate Pier program, as shown on the drawings, the Aggregate Pier contractor shall provide all labor, materials, and equipment to accomplish the following items of work.

    a. Pre-drilling of holes as necessary and stockpiling / disposal of spoil material per Division 31, “Earth Moving.”
    b. Construction of the Aggregate Piers to the lines and grades on the construction drawings, shop drawings and the delegated design drawings.

3. It shall be the Aggregate Pier contractor’s responsibility to determine and implement the systems and criteria to ensure that the specified design performance is achieved.

1.2 QUALIFIED CONTRACTORS

A. The Aggregate Pier contractor shall meet the requirements outlined herein.

1.3 DEFINITIONS

A. Aggregate Piers are columns of compacted aggregate used to reinforce the soil in order to increase bearing capacity and reduce settlement of a structure. The piers can be constructed with a down-hole vibrator or down-hole tamper.

B. Down-Hole Vibrators are specially-designed, high-energy depth vibrators. The horizontal vibrations are created by a motor and eccentric weight located near the tip of the vibrator. Extension tubes are bolted to the vibrator to allow it to be lowered to the necessary treatment depth.

C. Bottom Feed Vibrators are down-hole vibrators which are equipped with a tremie pipe through which the aggregate is fed to the tip of the vibrator. This equipment is most often used in soil conditions which are too soft or cohesionless to remain open when pre-drilled.

D. Down-Hole Tampers are proprietary high-energy impact apparatus. The vertical tamping energy is provided by a hammer which is connected to a round, beveled tamper. The apparatus is lowered into a pre-drilled hole to the required treatment depth.

E. Field Quality Control Representative (FQCR): The individual representing the Contractor, given specific inspection tasks identified in this specification.

F. Special Inspector: The individual representing the Owner's Special Inspection Firm, given specific inspection or observation tasks identified in this specification.

1.4 PERFORMANCE REQUIREMENTS

A. Design and construct appropriate Aggregate Piers with granular backfill material beneath all column foundations, wall foundations and slabs on grade to provide the following criteria upon completion.

1. Refer to the Structural Drawings for the designed minimum allowable soil bearing capacities and slab on grade subgrade modulus that must be achieved by these modified subgrades.
   Or 2, 3, 4
2. Minimum Allowable Bearing Pressure for Aggregate Pier Reinforced Soils: 3000 psf.
3. Minimum Aggregate Pier spacing for slabs on grade: 10 ft.
4. Minimum Slab on Grade Subgrade Modulus: 100 pci
5. Maximum total long term footing settlement shall be limited to 1-inch.
6. Maximum long term differential settlement between adjacent footings shall be limited to ½-inch.
7. Maximum angular deflection of footings shall be limited to δ/L=1/1250 (1/1250: differential movement / length).
8. Aggregate Pier installation shall create an improved foundation and slab on grade subgrade which will evenly support its bearing components.
9. Aggregate Piers shall extend through the soil and be founded on the underlying limestone and shale bedrock.
10. Design Life: 50 years minimum.

B. Aggregate Piers shall be constructed to a depth sufficient to satisfy the settlement criteria above. A modulus test shall be performed to verify the parameter values selected for the pier aggregate.

C. Aggregate Piers shall be placed to miss corridors, and utility line locations. Coordinate Aggregate Pier design locations with utility site plans.

1.5 SUBMITTALS

A. The following shall be submitted to the Architect within 24 hours of the official bid opening:

1. A list of at least five previously completed projects of similar scope and purpose for approval by the Owner's representative. The list shall include a description of the project, relative size, and contact person with phone number.

2. Professional Liability Insurance: The Aggregate Pier Designer and installer shall have Errors and Omissions design insurance for their work. The insurance policy should provide a minimum coverage of $2 million per occurrence. Submit proof of insurance.

B. The following shall be submitted to the Architect for review a minimum of two (2) weeks prior to the start of the work:

1. Resumes of the management, supervisory, and key personnel.
2. Delegated Design: An Aggregate Pier / ground improvement design based on the contract documents. The ground improvement design shall be designed and prepared by an engineer licensed in the Commonwealth of Kentucky that demonstrates that the program achieves the specified performances criteria as specified herein. The design should take into consideration the location of utility lines and where these lines enter and exit the building. Aggregate Pier locations should be designed to either miss entirely, or to accept utility line trenching. Backfill requirements and details shall be provided.

    a. Detailed plans shall be included that show the location and spacing of the piers.
    b. Detailed design calculations and a detailed explanation of the design parameters for settlement calculations shall be included.
    c. A quality control test program for the Aggregate Pier system, meeting the design requirements.
    d. AutoCAD files will be provided to the Engineer for use after the bids have been received and the successful bidder has been awarded a contract. These files will include the Survey, the Site Base Plan and the Site Grading Base Plan. A CADD release form will be filled out prior to release of the CADD files.

3. Shop drawings for review, indicating the spacing, location, pier diameters, depth of the Aggregate Piers, number of aggregate lifts and the compaction requirements of the individual piers to achieve the criteria outlined in this specification.
4. The project geotechnical report is provided for reference only and is not considered apart of the contract documents.
5. Modulus test detail and setup to confirm that the installation procedure produces the pier modulus used in the design.

C. The following shall be submitted to the Architect during the work:

1. Accurate daily records that include the type and size of compaction equipment and predrill auger diameter used, and, for each Aggregate Pier, the identification number and depth of the pier tip.
2. Any change in the subsurface conditions observed during the work.
3. The modulus test data, analysis of the data, and the concluding recommended design parameters, prepared by an engineer licensed in the Commonwealth of Kentucky.

D. The following shall be submitted to the Architect after the work is completed:

1. A report documenting the observations and results of the tests. This report will certify that the bearing pressure has been achieved within settlement tolerances.
2. As-built drawing/survey indicating the locations of the Aggregate Piers. Each pier shall be identified with the following information; the diameter and bearing capacity. This information will be used to coordinate utility line installation and footer excavations.

1.6 PROJECT CONDITIONS

A. Refer to Division 31, Sections “Site Clearing” and “Earth Moving” for existing project site conditions.

1.7 QUALITY ASSURANCE

A. The Aggregate Pier program shall be performed by a specialist Aggregate Pier contractor with at least five continuous years of documented experience in Aggregate Piers.

B. The Aggregate Pier contractor shall provide experienced management, supervisory and key personnel to implement the Aggregate Pier program.

C. Provide evidence of Aggregate Pier project experience.

D. The Contractor's representative (FQCR) and the Special Inspector will ensure that procedures and documentation conform to these specifications.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Down-Hole Vibrator

1. Should the Aggregate Pier contractor use a down-hole vibrator, the vibrator shall be capable of providing at least 80 HP of rated energy and a centrifugal force of 15 tons. An appropriate metering device should be provided at such a location that inspection of amperage increase may be verified during the operation of the equipment. The metering device may be an ammeter directly indicating the performance of the vibrator tip. Complete equipment specifications should be submitted to the Engineer prior to commencement of the fieldwork.

B. Down-Hole Tamper

Should the Aggregate Pier contractor use a down-hole tamper, the tamper shall have a diameter that is at least 90% of the pre-drilled hole diameter, have beveled sides, and be long enough to reach the full depth of the pre-drilled hole. The tamper shall have a minimum Construction Industry Manufacturer's Association (CIMA) rating of 1,225 ft-lb and shall apply direct downward impact energy to each lift of aggregate. A minimum tamper energy level of 490,000 ft-lbs of force per minute shall be applied by the energy source.

2.2 BACKFILL MATERIALS

A. Aggregates used shall be mechanically crushed natural rock or stone produced from a solid geologic formation by quarrying methods. Mechanically crushed shale stone materials are not suitable materials for use as backfill aggregate. Any other stone type that expands or degrades when in contact with water shall not be used.

B. Down-Hole Vibrator Method: The backfill aggregate should consist of hard, angular to sub-angular durable rock fragments, with the majority of particles in the range of 1/8th inch to 1-1/2 inches conforming to ASTM C33.

C. Down-Hole Tamper Method:

1. Aggregate used for piers constructed above the water table shall be Type I, Grade B in accordance with ASTM D1241.

2. Aggregate used for piers constructed below the water table, the gradation shall be the same as Type I Grade B, except that particles passing the number 40 sieve shall be eliminated. Alternately, No. 57 stone may be used.
3. When type I Grade B material is used, potable water or other suitable source shall be used to increase the aggregate moisture content to within the specified optimum moisture range per the Aggregate Pier designer.

2.3 MISCELLANEOUS MATERIALS

A. Water: Potable water for use to increase aggregate moisture content where required.

B. Casing: Casing of suitable strength and diameter to meet the requirements for installation of the Aggregate Piers.

PART 3 - EXECUTION

3.1 GENERAL INFORMATION

A. Proceed with Aggregate Pier construction after the following conditions are met:

1. Suitable building pad has been established for working and installing the Aggregate Piers. Notify the Construction Manager if conditions are not suitable for installation to proceed. Aggregate Pier installer accepts conditions of the building pad when proceeding with Aggregate Pier installation.
2. A location has been established on site for the wasting of soil materials excavated from the Aggregate Pier holes.
3. Aggregates are on site for use to fill holes.
4. The Aggregate Pier installer shall locate and protect existing underground and above-ground utilities and other structures from damage during installation of the Aggregate Piers.
5. The Aggregate Pier Designer shall work closely with the earthwork contractor to establish additional requirements or determine reduced requirements for the building pad preparation.

3.2 GENERAL GRADING REQUIREMENTS

A. Site Grades shall be verified prior to installation of the Aggregate Pier to be within 6 inches of the top of footing elevation or within 1 inch of finished subgrade elevations to minimize pier installation depths. Ground elevations and bottom of footing elevations are listed in the contract documents.

B. Work with the earthwork contractor to maintain a neat and clean building pad. Excess soil materials should be hauled off and not allowed to accumulate on the prepared building pad.

C. Coordinate with the earthwork contractor to maintain positive drainage away from Aggregate Piers, excavated holes and trenches.

3.3 GROUNDWATER

A. Groundwater should not be allowed to accumulate at the bottom of the excavated Pier holes. Pump out excess water prior to placement of the aggregate stone lifts.

B. Water will be disposed of away from other installed Aggregate Piers, open trench excavations and other construction areas. Do not let silt laden water dump directly into rivers, streams or creeks. Refer to Division 31, “Earth Moving” for additional dewatering information.

3.4 AGGREGATE PIER LAYOUT

A. The location of the Aggregate Piers for this project, including layout of the individual Aggregate Piers, shall be marked in the field using survey stakes or similar means at locations shown on the drawings. Layout the pier locations per the design to within the specified tolerances.

B. Protect stakes from damage and removal during installation of Aggregate Piers.

3.5 AGGREGATE PIER CONSTRUCTION

A. Stable Ground Conditions: The following general procedures shall be followed when the pre-drilled hole remains open during construction.

1. Pre-drilling / excavating to the design depth will be performed with an auger/vibrator diameter equal to the finished column diameter.
2. Down-Hole Vibrator Method: The quantity of aggregate initially added shall be such that the vibrator tip is able to penetrate to within 12 inches of the design depth. The vibrator will be raised and lowered repeatedly, such that on each re-penetration, the tip of the vibrator advances to within 12 inches of the previous penetration depth.
3. Down-Hole Tamper Method: Following placement of the first 12-inch lift of aggregate, the tamper is to be lowered to the top of the aggregate and activated. The full energy of the impactor and weight of the tamper shall be used for at least 30 seconds per lift, and subsequent lifts shall not exceed 12 inches in thickness.
4. The aggregate shall be removed and replaced with fresh aggregate if cave-ins occur during the aggregate placement such that the volume of caved-in soil is greater than 10 percent of the aggregate being compacted.

B. Unstable Ground Conditions: The following general procedures will be followed when a pre-drilled hole will not remain open before or during pier construction.

1. Pre-drilling / excavating to the design depth will be performed with an auger/vibrator diameter equal to the finished column diameter.
2. Down-Hole Vibrator Method: If the hole will remain temporarily stable, the hole may be filled with aggregate to a level above the instability as long as the vibrator is still able to penetrate to within 1 foot of the pre-drilled depth. If the hole will not remain temporarily stable, a Bottom Feed Down-Hole vibrator may be used.
3. Down-Hole Tamper Method: A casing with a minimum outside diameter equal to 100% of the pier diameter is advanced to the full treatment depth. The first 12-inch lift of aggregate will be placed, raise the casing to the top of the aggregate layer. Then lower the tamper to the top of the aggregate. The full energy of the impactor and weight of the tamper shall be used for at least 30 seconds per lift, and subsequent lifts shall not exceed 12 inches in thickness. The casing is extracted after each lift is placed with the bottom of the casing always maintained above the top of the aggregate lift.

C. Obstructions: Aggregate Piers shall be constructed within 3 inches of the design location. Obstructions encountered during excavation or drilling that will prevent installation of the

Aggregate Piers to design depth, or cause the Aggregate Pier to stray from its specified location during installation shall be removed. To the extent the obstructions are shown in the contract documents, removal of obstructions shall be performed at no additional cost to the owner.

1. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., that prevent installing the Aggregate Piers to the required depth, or cause the Aggregate Pier to drift from the required locations. Dense natural rock or weathered rock shall not be deemed obstructions, and piers may be terminated short of design lengths on such materials. The Aggregate Pier design engineer shall be notified within 24 hours to verify that the short piers are acceptable.

3.6 MISCELLANEOUS

Do not leave holes open overnight. Any excavated hole that will not be filled prior to the end of the days work, will need to be either filled with aggregate to subgrade elevations and then re-excavated or have casing installed to maintain the integrity of the soil wall and covered with a steel plate to prevent cave in and to protect the public should there be anyone on the job site after hours. Visually inspect any hole left open over night for the presence of cave-ins, water, or other materials detrimental to the Aggregate Pier.

A. Re-mobilization of the Aggregate Pier installer due to construction delays resulting from unsuitable building pad conditions, lack of coordination, reworking of aggregate piers that have failed or do not meet compaction requirements shall be performed at no additional cost to the owner.

3.7 FILLING AGGREGATE PIER HOLES

A. After Aggregate Piers have been installed to the required elevations, and after testing, surveying and other inspections have occurred, backfill with approved soils to finished subgrades. Refer to Division 31, “Earth Moving” for requirements of soil backfill.

3.8 CLEAN UP

A. After all Aggregate Piers have been installed, testing has approved the pier system and backfilling has taken place, remove from the building pad all construction equipment in a manner that does not disturb the building pad or the installed Aggregate Piers. A visible stake or flag shall be installed in the center of the pier to visually mark their locations.

3.9 SPECIAL INSPECTIONS

A. Refer to Division 01, Section “Special Inspections” for Special Inspection requirements.

3.10 FIELD QUALITY CONTROL

A. Contractor will be responsible for Field Quality Control Inspections.

1. All Aggregate Pier operations shall be performed under the observation and documentation of the FQCR. The Aggregate Pier installer will maintain a full time, on-site Control Technician.

2. Monitoring and logging of Aggregate Pier operations for both test and production work shall be done by the FQCR.
3. The FQCR will provide site observation and documentation to ensure performance of the Aggregate Pier work. This inspection will include the following: recording of predrilled/excavated hole depth, verification of the type of bearing strata, verifying bearing strata is clean and free of loose soil, documenting water level if encountered, documenting obstructions if encountered, noting casing depth and effectiveness, observance of the Aggregate Pier contractor's procedures, and recording of compaction energy information.
4. The foundation bearing surface shall be compacted and firm prior to the construction of the foundation.
5. The FQCR will coordinate all testing with the Special Inspector.
6. The FQCR will report immediately any unusual conditions encountered during installation of the Aggregate Piers to the Aggregate Pier Design Engineer, the Architect, the Construction Manager, Special Inspector and the Owners Representative.

B. Modulus Test

1. Testing to determine specification compliance will be provided by the Aggregate Pier contractor, and will consist of at least one modulus test of an Aggregate Pier. The results of the Modulus Test shall meet the following criteria to pass:

   a. The Owner's representative or the Architect shall approve of the location of the Modulus Test.
   b. Deflections of the top of the test pier shall be measured by a suitable method.
   c. Deflections at the bottom of the test pier shall be measured by means of a telltale installed at the bottom of the test Aggregate Pier. Performance will be deemed acceptable when, at the specified design stress, deflection at the bottom of the pier does not exceed 20% of the deflection at the top of the pier.
   d. Load increments, decrements, and duration, shall be determined using ASTM D1143 as general guidelines.
   e. Surficial disturbance shall be compensated for by applying a seating load equal to 5% of the total load to the loaded steel plate before applying load increments.
   f. The modulus testing shall be performed as described in the Design Submittal.

3.11 REJECTION OF AGGREGATE PIERS

A. If an Aggregate Pier is installed in an incorrect location or exceeds the specified tolerances, the Aggregate Pier contractor shall replace the pier. Pier replacement may be avoided if alternate remedial procedures are approved by the Designer. Unless the rejection is caused by obstruction, refusal in rock or dense soil or errors in the project drawings, the cost of all labor and material required for the replacement shall be the responsibility of the Aggregate Pier installer.

3.12 EXCAVATION OF PIER TOPS AND UTILITIES

A. Refer to Division 31, Section "Earth Moving" for requirements.

B. Coordinate Pier design locations with utility line locations.

3.13 FOOTING EXCAVATIONS

A. Refer to Division 31, Section “Earth Moving.”

END OF SECTION 02360

SECTION 02361 – MICROPILES/ROCK ANCHORS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fabrication and erection of grout encased steel micropiles, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of piles required.

B. Special definitions which apply to this section include:

1. Micropile: A small diameter pile consisting of steel core and grouted perimeter, in which most of the applied load is resisted by the central steel shaft and/or steel reinforcement. Load transfer to rock is primarily resisted via friction along the bond length. Consideration of added capacity acquired via end bearing is acceptable if accounted for in the micropile design. Refer to Geotechnical Report.

2. Rock Anchor: A small diameter pile consisting of steel core and grouted perimeter, in which all of the applied tension load is resisted by the central steel shaft and/or steel reinforcement. Load transfer to soil rock is resisted via friction along the bond length.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Structural Special Inspection.”
2. Division 3 Section “Cast-in-place Concrete.”

1.3 MEASUREMENT AND PAYMENT

A. Payment for Micropiles & Rock Anchors Basis will be made on a lump sum basis for all work defined herein including, but not limited to, design, fabrication, installation, pre-production load tests, and production load testing. All cost shall be included in the base bid.

1.4 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International:

1. ASTM A29/A29M Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished.
2. ASTM A36/A36M Structural Steel.
3. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
4. ASTM A153 Zinc Coating (Hot Dip) on Iron and Steel Hardware.
5. ASTM A775 Electrostatic Epoxy Coating

6. ASTM A193/A193M Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.
7. ASTM A252 Welded and Seamless Steel Pipe Piles.
8. ASTM A320/A320M Alloy-Steel Bolting Materials for Low Temperature Service.
9. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
10. ASTM A572 HSLA Columbium-Vanadium Steels of Structural Quality.
11. ASTM A618 Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
12. ASTM A656 Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability.
13. ASTM A1018 Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength, Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability.
14. ASTM C33 Concrete Aggregates.
15. ASTM C109 Compressive Strength of Hydraulic Cement Mortar.
16. ASTM C150 Portland Cement.
17. ASTM C494 Chemical Admixtures for Concrete.
18. ASTM C618 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
19. ASTM C1240 Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
20. ASTM C1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
21. ASTM D1143 Method of Testing Piles Under Static Axial Compressive Load.
22. ASTM D1784 Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
23. ASTM D1785 Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
24. ASTM D3034 Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
25. ASTM D3689 Method of Testing Individual Piles Under Static Axial Tensile Load.
26. ASTM D3966 Standard Test Method for Piles Under Lateral Load.

C. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code – Steel.
2. AWS D1.2 Structural Welding Code – Reinforcing Steel.

D. American Society of Civil Engineers (ASCE):

1. ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations.

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer and fabricate piles and pile cap embeds to resist forces specified. See drawings for loading criteria.

B. Engineering Responsibility: Engage a manufacturer who utilizes a qualified professional engineer to prepare design calculations, shop drawings, and other structural data for micropiles.

C. Design micropile & rock anchors to meet the specified loads and acceptance criteria as shown on the drawings.

D. Design mciropile & rock anchors cap plate to adequately transfer the required loading to the foundation element.

E. Minimum factor of safety shall for completed micropile (all components) shall be 2.0 in Compression and Shear.

F. Minimum factor of safety shall for completed micropile and rock anchors (all components) shall be 3.0 in Tension.

1. Limit steel stresses to 90% of yield for Rock Anchors.

1.6 SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

B. Product Data including manufacturer's data product sheet for specified products and other data to show compliance with the specifications (including specified standards).

C. Shop Drawings showing profiles and product components, including anchorages and accessories.

1. Drawings shall indicate profiles and product components and accessories and indicate the following:

a. Micropile/Rock Anchor number, location and pattern by assigned identification number.
b. Micropile/Rock Anchor design load.
c. Type and size of central steel shaft.
d. Displacement plates/centralizers, if applicable, and their location.
e. Minimum overall length.
f. Inclination of Micropile/Rock Anchor.
g. Grout column length.
h. Minimum required bond length to rock.
i. Minimum cased length, if applicable.
j. Grout column diameter(s).
k. Cutoff elevation.
l. Micropile cap or Rock Anchor embed plate detailing and attachment to pile.
m. Micropile/Rock Anchor attachment to structure relative to grade beam, column pad, etc.

2. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation. The engineer shall be licensed to practice in the State of Kentucky.
3. Shop drawings which show the Architect's or Engineer's title block, logo and/or seal will be rejected and returned unchecked.
4. Computer generated electronic structural construction document files (ACAD) will be made available to the Contractor. The Contractor will be required to sign the Engineer's standard release of liability form prior to receiving the drawing files.
5. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.

D. Erection plan showing layout of all piles with dimensions between piles and to bearing walls and columns.

E. Manufacturer's installation instructions.

F. Structural Calculations.

1. Furnish electronic pdf copies of structural calculations of all Micropiles/Rock Anchor at time of Shop Drawing submittal.
2. Show loading, section modulus, assumed allowable stress, stress diagrams and calculations, rock surface bond stress, bond length and similar information needed for analysis and to ensure that piles comply with requirements.
3. Calculations shall be signed and sealed by a qualified professional engineer licensed to practice in the State of Kentucky.
4. Architects and Engineers review of the calculations is for general conformance with the contract documents. Actual calculations are the responsibility of the underpinning pile design engineer and shall not be reviewed for content or accuracy by the Architect or Engineer.

G. Closeout Submittals:
1. Record Documents: Project record documents for installed materials.
2. Load certification: The contractor shall submit a letter certifying that the piles (as installed) meet or exceed the loading criteria shown on the drawings. The letter shall be sealed, signed and dated by the engineer in responsible charge of the design of the piling system.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed steel Micropile/Rock Anchor work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating steel Micropiles/Rock Anchors similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate steel piles without delaying the Work.

C. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the State of Kentucky and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with Micropiles/Rock Anchors that are similar to that indicated for this Project in material, design, and extent.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver steel Micropiles/Rock Anchor and materials to Project site in such quantities and at such times to ensure continuity of installation.

B. Handle and store steel micropiles with care and in accordance with manufacturer's instructions.

C. Time delivery and installation of piles to avoid extended on-site storage and to avoid delaying work of other trades.

PART 2 – PRODUCTS

2.1 PILE COMPONENTS

A. Pile components shall be selected by the pile manufacturer and installer. The engineer responsible for the design of the pile system shall list applicable ASTM standards utilized for design of each component.

B. Hollow steel pile shafts shall be perforated to allow grout to completely fill the shaft during installation.

C. Pipe/Casing:

1. For steel casing relied upon to carry compression loads, or to stiffen the Micropile, the casing/pipe shall conform to requirements of ASTM A53 Type E or S Grade B, ASTM A252 Grade 2, ASTM A500 Grade B or ASTM A618.
2. For PVC casing relied upon for grout containment, fissured or void-filled soils, or as a bond breaker, the casing/pipe shall conform to ASTM D1784, ASTM D1785 and ASTM D3034.
3. Where pipe casing is to remain as a permanent part of the micropile installation, said casing shall be hot-dip galvanized.

2.2 CEMENT GROUT

A. Portland Cement: ASTM C 150, Type I. High early strength (when specified), ASTM C150, Type III.

B. Water: Potable.

C. Aggregate:

1. Sand fillers may be used in the grout mix as an extender with large diameter grout columns, subject to the approval of the Owner. Do not include aggregate in small diameter grout columns.
2. Use fine sand only. Do not use medium or coarse sand.

D. Admixtures and Chemical Admixtures:

1. Conform to the requirements of ASTM C494. Do not use accelerators.
2. Chemical admixtures, if used, shall be compatible with the central steel shaft and mixed in accordance with the grout manufacturer’s recommendations.
3. Chemical admixtures which control bleed water, improve consistency, reduce water/cement ratio and retard set may be used in the grout subject to the review and acceptance of the Owner.
4. Expansive admixtures may be used to fill confined areas of the central steel shaft coupling joints or to compensate for drying shrinkage.

2.3 SOURCE QUALITY

A. Source Quality: Obtain proprietary Micropile/Rock Anchor products from a single manufacturer.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the micropile contractor present, verify elevations of concrete bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Unless other satisfactory agreements are made between the Micropile contractor and the general contractor, all of the necessary mass site excavation and filling shall be performed by the General Contractor.

3.3 INSTALLATION

A. General: The pile sections shall be installed per manufacturer's recommendations in conjunction with the calculations as performed by the engineer in responsible charge of the design of the micropile system.

1. The Micropile/Rock Anchor installation technique shall be consistent with the geotechnical, logistical, environmental and load carrying conditions of the project. Install technique shall adhere to general installation procedures as follows:

a. Advance casings of the micropiles into bedrock for the required depth.
b. Remove drill rod, leave steel casing in place.
c. Install reinforcement bar or other central steel loading carrying element in the casing as required per the pile design.
d. Fill the casing with cement grout using pressurized injection system.
e. Lift casing as required to permit grout bond to adjacent rock.
1) If casing is not part of permanent pile system, remove casing entirely.
f. Cut off top of micropile at the required elevation for detailing.
g. Cap micropile per the design of the micropile design Engineer.
h. Load test micropiles as specified.

B. Termination Criteria:

1. If the Micropile/Rock Anchor is refused or deflected by a subsurface obstruction,

terminate the installation and remove the pile/anchor. Remove the obstruction, if feasible, and reinstall the Micropile/Rock Anchor. If not feasible to remove the obstruction, install the Micropile/Rock Anchor at an adjacent location, subject to review and acceptance by the Owner.

C. Site Tolerances: Install Micropile/Rock Anchor to the following allowable variation:

1. Centerline of piling shall not be more than 3 inches (76 mm) from indicated plan location.
2. Pile plumbness shall be within 2 degrees of design alignment.
3. Top elevation of pile shall be within +1 inch (25 mm) to -2 inches (-50 mm) of the design vertical elevation.
4. Centerline of central steel shaft shall not be more than 3/4 inch (19 mm) from the centerline of the pile.

3.4 FIELD QUALITY CONTROL

A. Installation Records: Provide the Owner copies of Micropile installation records within 24 hours after each installation is completed. Include, at a minimum, the following information.

1. Name of project and Contractor.
2. Name of Contractor's supervisor during installation.
3. Date and time of installation.
4. Name and model of installation equipment.
5. Location of Micropile/Rock Anchor by assigned identification number.
6. Actual Micropile/Rock Anchor type and configuration - including manufacturer's SKU numbers where applicable.
7. Micropile/Rock Anchor installation duration and observations.
8. Total length of installed Micropile/Rock Anchor.
9. Cutoff elevation.
10. Inclination of Micropile/Rock Anchor.
11. Grout quantities pulled down on a per section basis.
12. Actual grout column diameter and length.
13. Comments pertaining to interruptions, obstructions or other relevant information.
14. Rated load capacities.

B. Load testing shall be the responsibility of the Micropile/Rock Anchor installation Contractor.. The Special Inspector shall be present to observe, but not perform, all load tests.

C. Pre – Production Load Test Procedures

1. The Contractor shall perform Pre-Production Load test on 1 micropile prior to the installation of the remaining piles. Pre-production micropiles are not permitted to be part of the permanent structure subject to passing load testing.
   a. If Pre-Production micropiles are not used as part of the permanent structure, they shall be cutoff 36-inches minimum below the finished grade surface.
2. The hydraulic jack shall be positioned at the beginning of the test such that the unloading and repositioning of the jack during the test shall not be required. The jack shall also be positioned co-axial with respect to the pile-head so as to minimize eccentric loading. The hydraulic jack shall be capable of applying a load not less than two times the proposed design load (DL).
3. An alignment load (AL) shall be applied to the Micropile prior to setting the deflection measuring equipment to zero or a reference position. The AL shall be no more than

10% of the design load (i.e., 0.1 DL). After AL is applied, the test set-up shall be inspected carefully to ensure it is safe to proceed.

4. Micropile load tests shall be conducted by loading the Micropile in step-wise fashion as shown in Table-1 to the extent practical. Pile-head deflection shall be recorded at the beginning of each step and after the end of the hold time. The beginning of the hold time shall be defined as the moment when the load equipment achieves the required load step.

Table-1. Steps for Pre-Production Load Testing

LOAD STEP	HOLD TIME (MINUTES)
AL	2.5 Min.
0.20 DL	2.5 Min.
0.40 DL	2.5 Min.
0.50 DL	2.5 Min.
0.20 DL	1.0 Min.
AL	1.0 Min.
0.40 DL	1.0 Min.
0.60 DL	2.5 Min.
0.80 DL	2.5 Min.
1.0 DL	2.5 Min.
0.5 DL	1.0 Min.
0.2 DL	1.0 Min.
AL	1.0 Min.
0.5 DL	1.0 Min.
1.0 DL	1.0 Min.
1.2 DL	2.5 Min.
1.4 DL	2.5 Min.
1.6 DL	2.5 Min.
1.8 DL	2.5 Min.
2.0 DL	10 Min.

1.5 DL	1.0 Min.
1.0 DL	1.0 Min
0.5 DL	1.0 Min
AL	5.0 Min

AL = Alignment Load; DL = Design Load

5. Test loads shall be applied until continuous jacking is required to maintain the load step or until the test load increment equals 200% of the design load (DL) (i.e., 2.0 DL), whichever occurs first. The observation period for this last load increment shall be 10 minutes. Displacement readings shall be recorded at 1, 2, 3, 4, 5 and 10 minutes (load increment maxima only).
6. The applied test load shall be removed in three approximately equal decrements per the schedule in Table-3. The hold time for these load decrements shall be 1 minute, except for the last decrement, which shall be held for 5 minutes.

D. Acceptance Criteria for Micropile Verification Load Tests

1. Both of the following criteria must be met for approval:

   a. The Micropile shall sustain the design capacity (1.0 DL) with no more than 1/2-inch total vertical movement of the pile head as measured relative to the top of the Micropile prior to the start of testing.
   b. Failure does not occur at the 2.0 DL maximum test loads. The failure load shall be defined by one of the following definitions – whichever results in the lesser load:

      1) The point at which the movement of the Micropile tip exceeds the elastic compression/tension of the pile shaft by 0.08 B, where B is defined as the diameter of the largest helix.
      2) The point at which the slope of the load versus deflection (at end of increment) curve exceeds 0.05 inches/kip.

2. The Contractor shall provide the Owner copies of field test reports confirming Micropile configuration and construction details within 24 hours after completion of the load tests. This written documentation will either confirm the load capacity as required on the working drawings or propose changes based upon the results of the pre-production tests.
3. When a Micropile fails to meet the acceptance criteria, modifications shall be made to the design, the construction procedures, or both. These modifications include, but are not limited to modifying the installation methods and equipment, increasing or decreasing the grout column diameter, increasing the grout column bond length, or changing the Micropile material (i.e., central steel shaft, grout mix, etc.). Modifications that require changes to the structure shall have prior review and acceptance of the Owner. Changes to Micropile system shall be made at no additional cost to Owner.

E. Production Pile Testing

1. The Contractor shall perform proof tests (Production Pile Tests) on a minimum of 10% of the total production Rock Anchors. The piles to be tested will be selected by the Engineer.
2. The test sequence shall be as shown in Table-2 to the extent practical.

Table-2. Steps for Production Load Testing

LOAD STEP	HOLD TIME (MINUTES)
AL	0 Min.
0.20 DL	2.5 Min.
0.40 DL	2.5 Min.
0.60 DL	2.5 Min.
0.80 DL	2.5 Min.
1.00 DL	5 Min.
0.60 DL	1 Min.
0.40 DL	1 Min.
0.20 DL	1 Min.
AL	5 Min.

AL = Alignment Load; DL = Design Load

3. The acceptance criteria for production Rock Anchor shall be per Load Test Acceptance stated above.
4. If a production Rock Anchor that is tested fails to meet the acceptance criteria, the Contractor shall be directed to proof test another Rock Anchor in the vicinity. For failed piles and further construction of other piles, the Contractor shall modify the design, the construction procedure, or both. These modifications include, but are not limited to, replacing the deficient Rock Anchor/s, de-rating the Rock Anchor load capacity, modifying the installation methods and equipment, increasing or decreasing the grout column diameter, changing the pile configuration, increasing the grout column rock bond length, or changing the Rock Anchor material (i.e., central steel shaft, grout mix, etc.) Modifications that require changes to the structure shall have prior review and acceptance of the Owner. Changes to Rock Anchor system shall be made at no additional cost to Owner.

F. Site Test Records: Provide the Owner copies of field test reports within 24 hours after completion of the load tests. Include, at a minimum, the following information:

1. Name of project and Contractor.
2. Name of Contractor’s supervisor during installation.
3. Name of third party test agency, if required.

4. Date, time and duration of test.
5. Location of Micropile/Rock Anchor by assigned identification number.
6. Type of test (i.e., tension or compression).
7. Description of calibrated testing equipment and test setup.
8. Actual Micropile/Rock Anchor type and configuration - including lead section, number and type of extension sections (manufacturer's SKU numbers).
9. Steps and duration of each load increment.
10. Cumulative pile-head movement at each load step.
11. Comments pertaining to test procedure, equipment adjustments or other relevant information.
12. Signed by third party test agency representative or registered professional engineer.

END OF SECTION 02361

SECTION 02500

BITUMINOUS PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF THE WORK

Extent of bituminous pavement paving is shown on the Drawings, including roads, driveways and parking areas.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Unless noted, all specification designations refer to the Kentucky Department of Highways Standard Specifications, (KDOHSS) Latest Edition. Appropriate portions of the referenced sections of the Specifications shall apply, but all work shall be included in bid items described herein unless otherwise specified or shown on the Drawings.

B. Preparation of subbase is specified in this Division, Section 02200.

C. Crushed stone and dense graded aggregate are specified in this Division, Section 02255.

1.03 QUALITY ASSURANCE

A. Performance: Bituminous seal coat that fails as the result of not meeting the requirements of these Specification shall be corrected at the Contractor's expense.

B. The design plant mix shall be submitted to the Engineer for review and acceptance. The submittal shall include the last date the mixture was approved by the Kentucky Department of Highways for use on a state road project; and the location where the mixture was recently used, and the name and address of the paving contractor.

PART 2 - PRODUCTS

2.01 BITUMINOUS CONCRETE SURFACE MATERIAL

A. Aggregates shall meet the applicable requirements of the KDOHSS.

B. Bituminous materials shall meet the applicable requirements of the KDOHSS.

C. Bituminous materials for tack coat shall be one of the following: SS-1, SS-1h, CSS-1, CSS-1h, AE-60, RS-1, CRS-1, RC-70 or RC-250.

D. Steel, wood or other suitable material shall be of size and strength necessary to resist movement during bituminous placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

2.02 BITUMINOUS SEAL COAT MATERIAL

A. Coarse aggregate shall be Kentucky Department of Highways Standard Size No. 8, meeting applicable requirements of Section 805 of KDOHSS.

B. Bituminous materials shall meet applicable requirements of Section 806 of KDOHSS.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

The road shall be swept with an approved mechanical sweeper and with wire hand brooms, when necessary. Special care shall be taken to clean the edges of the surface so that full width of the roadway to be treated shall be uniformly clean. Where any mud or earth exists, it shall be removed sufficiently in advance of application of bituminous material to allow the surface to become thoroughly dry.

3.02 BITUMINOUS CONCRETE PAVING

A. Composition of Mixtures: Surface pavement mixture, meeting requirements of the KDOHSS shall be used as determined by local plant mix availability. The mixture shall have been approved recently by the Kentucky Department of Highways, used recently on a state project, and conform to the requirements below when tested in accordance with ASTM D 1559-76:

Stability, minimum pounds	1200
Flow, 0.01 inch	Min. 6, Max. 16
Percent air voids	Min. 4, Max. 8
Minimum voids in mineral aggregate,	
percent: 3/4 inch	14
1 inch	13

B. Construction Methods: Construction requirements shall conform to applicable requirements of the KDOHSS.

C. A tack coat shall be required to bond new paving to the surface of concrete or brick pavements and bases or existing bituminous surfaces. It shall be applied in accordance with Section 407 of KDOHSS.

D. Where bituminous paving is placed against vertical surfaces such as curbs, gutters, manhole frames, valve boxes, etc., the vertical face shall be tack coated to seal the surface. Where these surfaces are inaccessible to pressure distributor, the tack coat may be brushed or broomed into place. The tack coat shall not be allowed to spill over onto any horizontal surface outside the area to be paved.

E. Unless otherwise indicated on the Drawings or in these Specifications, the compacted thickness of the bituminous concrete paving shall be a minimum of 2 inches and the minimum ambient temperature for placing shall be 40 deg F. Mixing and laying temperatures shall be as follows:

Aggregates	Min. 240 deg F Max. 325 deg F
Asphalt Cement	Min. 225 deg F Max. 325 deg F
Mixture at Plant (measured in truck)	Min. 240 deg F Max. 325 deg F
Mixture when Placed (measured in truck when discharging)	275 deg $\pm$ 20 deg F**

**The 275 deg F + 20 deg F mixture placing temperature is based on 275 deg F being about the ideal temperature for obtaining optimum compaction under average conditions. However, when the distance between asphalt plant and the job is such that specified placing temperatures cannot be maintained even though maximum mixing temperatures are covered, insulated hauling equipment as described below are used, the minimum placing temperature shall be 225 deg F.

F. Trucks for hauling bituminous mixtures shall have tight, clean and smooth metal beds that have been sprayed with a minimum amount of soap emulsion, paraffin oil, or other approved material

that is not detrimental to the mixture to prevent the mixture from adhering to the beds. All trucks shall be equipped with covers of sufficient size to completely cover the located material and all covers shall be securely fastened in place before the truck leaves the plant. Truck beds shall be insulated, when necessary, to maintain the specified temperature to the point of delivery. Any truck causing excessive segregation of material by its spring suspension or other contributing factors shall be discharged from the work until such conditions are corrected.

G. The Contractor shall have an accurate thermometer on the job at all times for verifying all temperature requirements and for taking temperature measurements whenever requested by the Engineer or Owner. The Contractor shall closely control temperature and compaction requirements to achieve quality bituminous paving and related work.

H. Bituminous paving that fails as the result of not meeting the requirements of these Specifications shall be removed and replaced at the Contractor's expense.

- END OF SECTION -

SECTION 02502

RESTORATION OF SURFACES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes restoration and maintenance of all types of surfaces, sidewalks, curbs, gutters, culverts and other features disturbed, damaged or destroyed during the performance of the work under or as a result of the operations of the Contract.

B. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to the condition of each before the work began.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American Society for Testing and Materials (ASTM)

a. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3)

1.03 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall be submitted:

1. A schedule of restoration operations. After an accepted schedule has been agreed upon it shall be adhered to unless otherwise revised with the approval of the Engineer.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. In general, permanent restoration of paved surfaces will not be permitted until one months' time has elapsed after excavations have been completely backfilled as specified. A greater length of time, but not more than nine months may be allowed to elapse before permanent restoration of street surfaces is undertaken, if additional time is required for shrinkage and settlement of the backfill.

B. The replacement of surfaces at any time, as scheduled or as directed, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

3.02 TEMPORARY PAVEMENT

A. Immediately upon completion of refilling of the trench or excavation, the Contractor shall place a temporary pavement over all disturbed areas of streets, driveways, sidewalks, and other traveled places where the original surface has been disturbed as a result of his operations.

B. Unless otherwise specified or directed the temporary pavement shall consist of compacted run-of-crusher limestone to such a depth as required to withstand the traffic to which it will be subjected.

C. Where concrete pavements are removed, the temporary pavement shall be surfaced with "cold patch". The surface of the temporary pavement shall conform to the slope and grade of the area being restored.

D. For dust prevention, the Contractor shall treat all surfaces, not covered with cold patch, as frequently as may be required.

E. The temporary pavement shall be maintained by the Contractor in a safe and satisfactory condition until such time as the permanent paving is completed. The Contractor shall immediately remove and restore all pavement as shall become unsatisfactory.

3.03 PERMANENT PAVEMENT REPLACEMENT

A. The permanent and final repaving of all streets, driveways and similar surfaces where pavement has been removed, disturbed, settled or damaged by or as a result of performance of the Contract shall be repaired and replaced by the Contractor, by a new and similar pavement.

1. The top surface shall conform with the grade of existing adjacent pavement and the entire replacement shall meet the current specifications of the local community for the particular types of pavement.

2. Where the local community has no specification for the type of pavement, the work shall be done in conformity with the State Department of Transportation Standard which conforms the closest to the type of surfacing being replaced, as determined by the Engineer.

3.04 PREPARATION FOR PERMANENT PAVEMENT

A. When scheduled and within the time specified, the temporary pavement shall be removed and a base prepared, at the depth required by the local community or Highway Permit, to receive the permanent pavement.

1. The base shall be brought to the required grade and cross-section and thoroughly compacted before placing the permanent pavement.

2. Any base material which has become unstable for any reason shall be removed and replaced with compacted base materials.

B. Prior to placing the permanent pavement all service boxes, manhole frames and covers and similar structures within the area shall be adjusted to the established grade and cross-section.

C. The edges of existing asphalt pavement shall be cut a minimum of 1 foot beyond the excavation or disturbed base whichever is greater.

1. All cuts shall be parallel or perpendicular to the centerline of the street.

3.05 ASPHALT PAVEMENT

A. The permanent asphalt pavement replacement for streets, driveways and parking area surfaces shall be replaced with bituminous materials of the same depth and kind as the existing unless otherwise specified.

B. Prior to placing of any bituminous pavement a sealer shall be applied to the edges of the existing pavement and other features.

C. The furnishing, handling and compaction of all bituminous materials shall be in accordance with the State Department of Transportation Standards.

3.06 CONCRETE PAVEMENT AND PAVEMENT BASE

A. Concrete pavements and concrete bases for asphalt, brick or other pavement surfaces shall be replaced with Class "B" Concrete, air-entrained.

B. Paving slabs or concrete bases shall be constructed to extend 1 foot beyond each side of the trench and be supported on undisturbed soil. Where such extension of the pavement will leave less than 2 feet of original pavement slab or base, the repair of the pavement slab or base shall be extended to replace the slab to the original edge of the pavement or base unless otherwise indicated on the Contract Drawings.

C. Where the edge of the pavement slab or concrete base slab falls within the excavation, the excavation shall be backfilled with Special Backfill compacted to 95% maximum dry density as determined by ASTM D 698 up to the base of the concrete.

D. The new concrete shall be of the same thickness as the slab being replaced and shall contain reinforcement equal to the old pavement.

1. New concrete shall be placed and cured in accordance with the applicable provisions of the State Department of Transportation Standards.

3.07 STONE OR GRAVEL PAVEMENT

A. All pavement and other areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.

1. The depth of the stone or gravel shall be at least equal to the existing.

2. After compaction the surface shall conform to the slope and grade of the area being replaced.

3.08 CONCRETE WALKS, CURBS AND GUTTER REPLACEMENT

A. Concrete walks, curbs and gutters removed or damaged in connection with or as a result of the construction operations shall be replaced with new construction.

1. The minimum replacement will be a flag or block of sidewalk and 5 feet of curb or gutter.

B. Walks shall be constructed of Class "B" concrete, air-entrained with KY-DOT #2 stone aggregate on a 4-inch base of compacted gravel or stone.

1. The walk shall be not less than 4 inches in thickness or the thickness of the replaced walk where greater than 4 inches, shall have construction joints spaced not more than 25 feet apart, shall have expansion joints spaced not more than 50 feet apart and shall be sloped at right angles to the longitudinal centerline approximately inch per foot of width.

C. 1/2-inch expansion joint material shall be placed around all objects within the sidewalk area as well as objects to which the new concrete will abut, such as valve boxes, manhole frames, curbs, buildings and others.

D. Walks shall be hand-floated and broom-finished, edged and grooved at construction joints and at intermediate intervals matching those intervals of the walk being replaced.

1. The intermediate grooves shall be scored a minimum of 1/4 of the depth of the walk.

2. The lengths of blocks formed by the grooving tool, and distances between construction and expansion joints shall be uniform throughout the length of the walk in any one location.

E. The minimum length of curb or gutter to be left in place or replaced shall be 5 feet. Where a full section is not being replaced, the existing curb or gutter shall be saw cut to provide a true edge.

1. The restored curb or gutter shall be the same shape, thickness and finish as being replaced and shall be built of the same concrete and have construction and expansion joints as stated above for sidewalks.

F. All concrete shall be placed and cured as specified in the Section for concrete.

3.09 LAWNS AND IMPROVED AREAS

A. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface.

1. If the depth of existing topsoil prior to construction was greater than 4 inches, topsoil shall be replaced to that depth.

B. The furnishing and placing of topsoil, seed and mulch shall be in accordance with the Section entitled "Topsoil and Seeding".

C. When required to obtain germination, the seeded areas shall be watered in such a manner as to prevent washing out of the seed.

D. Any washout or damage which occurs shall be regraded and reseeded until a good sod is established.

E. The Contractor shall maintain the newly seeded areas, including regrading, reseeding, watering and mowing, in good condition.

3.10 CULTIVATED AREA REPLACEMENT

A. Areas of cultivated lands shall be graded to a depth to receive topsoil of not less than the depth of the topsoil before being disturbed. All debris and inorganic material shall be removed prior to the placing of the topsoil.

B. The furnishing and placing of topsoil shall be in accordance with the Section entitled "Topsoil and Seeding".

C. After the topsoil has been placed and graded, the entire area disturbed during construction shall be cultivated to a minimum depth of 12-inches with normal farm equipment.

1. Any debris or inorganic materials appearing shall be removed.

2. The removal of stones shall be governed by the adjacent undisturbed cultivated area.

D. Grass areas shall be reseeded using a mixture equal to that of the area before being disturbed, unless otherwise specified.

3.11 OTHER TYPES OF RESTORATION

A. Trees, shrubs and landscape items damaged or destroyed as a result of the construction operations shall be replaced in like species and size.

1. All planting and care thereof shall meet the standards of the American Association of Nurserymen.

B. Water courses shall be reshaped to the original grade and cross-section and all debris removed. Where required to prevent erosion, the bottom and sides of the water course shall be protected.

C. Culverts destroyed or removed as a result of the construction operations shall be replaced in like size and material and shall be replaced at the original location and grade. When there is minor damage to a culvert and with the consent of the Engineer, a repair may be undertaken, if satisfactory results can be obtained.

D. Should brick pavements be encountered in the work, the restoration shall be as set forth in the Special Provisions or as directed.

3.12 MAINTENANCE

A. The finished products of restoration shall be maintained in an acceptable condition for and during a period of one year following the date of Substantial Completion or other such date as set forth elsewhere in the Contract Documents.

-END OF SECTION-

SECTION 02600

YARD PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all yard piping and appurtenances as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A.	EARTHWORK:	SECTION 02200
B.	YARD VALVES:	SECTION 02610

1.03 SUBMITTALS

A. A notarized certification shall be furnished for all pipe and fittings that verifies compliance with all applicable specifications. The requirement for this certification does not eliminate the need for shop drawings submittals in compliance with SECTION 01300.

1.04 EXISTING CONDITIONS

A. The existing piping shown on the Contract Drawings is based on the best available information. The Engineer makes no guarantee as to the accuracy of the locations or type of piping depicted. All new piping which ties into existing lines must be made compatible with that piping. So that piping conflicts may be avoided, Contractor shall open up his trench well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to AWWA C151, latest revision Class 250, with push-on joints unless otherwise noted on Drawings.

B. The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C104, latest revision. Thickness of the lining shall be as set forth in the aforementioned specification unless otherwise directed by the Engineer. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.

C. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or the word "DUCTILE". Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA or ANSI specifications.

D. Fittings shall be ductile iron and rated for a minimum of 250 psi in accordance with AWWA C110, latest revision. Fittings shall have push-on joints meeting the requirements of AWWA C111-80. Fittings shall have interior cement-mortar lining as specified for the pipe. Compact ductile from fittings meeting the requirements of AWWA C153 will also be

acceptable.

E. Provide AWWA C110 mechanical joint plugs and locked or restrained pipe joints where indicated on Drawings. Fittings under structures shall be mechanical joint with retainer glands. Retainer glands shall be of the “wedge action” design, where tightening the screws causes the wedge to lock onto the pipe. Retainer glands shall be Uni-Flange Series 1400 or equal.

2.02 POLYVINYL CHLORINE (PVC) PLASTIC PRESSURE PIPE

A. PVC Pressure Pipe, 3" and Smaller: Polyvinyl chloride plastic pipe shall be ASTM D 1785 Schedule 80 with solvent weld joints. Fittings shall be ASTM D 2467 Schedule 80 socket type. All socket type connections shall be made with PVC solvent cement complying with ASTM D 2564. PVC solvent cement shall be furnished from the same supplier as the PVC pipe. Provide socket-threaded adapters for connection to threaded appurtenances where required.

B. PVC Pressure Piping, 4" and Larger: PVC mains shall be polyvinyl chloride plastic pipe, Class 200 (SDR-21) pressure rated pipe. All PVC pipe shall conform to the latest revisions of the following:

ASTM D 2241 Standard Dimension Ratio SDR-21 (200 psi)

C. Fittings for the pipe shall be constructed of the same plastic material as is used for the pipe, minimum 200 psi pressure rating, gasketed and shall be of the molded type or machined from extruded stock.

D. Joints for polyvinyl chloride (PVC) mains shall be integral bell and spigot type joints with rubber O-ring gasket. The cleaning and assembling of the pipe joints shall be in accordance with manufacturer's recommendations.

2.03 POLYVINYL CHLORIDE (PVC) PLASTIC NON-PRESSURE PIPE

A. PVC Non-Pressure (Sewer) Pipe (6" thru 15"):

1. PVC sewer pipe shall be ASTM D3034, SDR 35, with ASTM D3213 integral bell and spigot rubber gasketed joints. Gasketed fittings shall conform to the same specifications and be supplied with the pipe.

B. PVC Non-Pressure (Sewer) Pipe (18" thru 36"):

1. Large diameter PVC sewer pipe and fittings shall meet the requirements of ASTM F679, SDR 35, with ASTM D3213 integral bell and spigot rubber gasketed joints. Gasketed fittings shall conform to the same specifications and be supplied with the pipe. PVC pipe shall not be used at depths exceeding sixteen (16) feet.

2.04 PIPE EMBEDMENT & BACKFILL MATERIALS (Per ASTM D2321)

A. Classes of Embedment and Backfill Materials are defined in ASTM D2321. Embedment Materials are those used for bedding, haunching and initial backfill.

B. Class 1A and Class 2 materials are acceptable for Pipe Embedment.

C. Class 1, 2, 3 and 4A materials are acceptable for Final Backfill, compacted 85% Standard Proctor Density except that Class 4A material must be compacted to 95% Standard Proctor

Density and Class 4A material is not allowed for backfill under pavement or traffic areas or in trenches where water content may cause instability of uncontrolled water content.

1. No rocks larger than 3" shall be incorporated into the Final Backfill materials.

D. Class 1A Manufactured Aggregates: Open graded clean, angular, crushed stone or rock. These materials compact with little or no mechanical effort.

E. Class 1B Manufactured, Processed Aggregate: Dense graded clean, angular crushed stone. Compact to 85% Standard Proctor Density with hand tampers or vibratory compaction.

F. Class 2: Clean, coarse-grained materials, such as gravel, coarse sands, and gravel/sand mixtures (1" maximum size). The materials are classified by the Unified Soil Classification System as GW, GP, SW, SP, and GW-GC or SP-SM. Hand tamping or mechanical vibration is required to provide the necessary 85% Standard Proctor Density. Class 3: Coarse-grained materials with fines including silty or clayey gravels or sands.

G. Gravel or sand must comprise more than 50% of Class 3 materials (1" maximum size). Soils classified as GM, GC, SM or SC meets these requirements. Hand tamping or mechanical vibration is required to provide the necessary 90% Standard Proctor Density.

H. Class 4: Fine-grained materials, such as fine sands and soils, containing 50% or more clay or silt. Soils classified as Class 4A (ML or CL) have medium to low plasticity. Soils classified as Class 4B (MH or CH) have high plasticity and are NOT allowed as embedment or backfill materials.

2.05 CONNECTION OF NEW UTILITIES TO EXISTING SYSTEM

A. The Contractor shall connect the new utilities to the existing system where shown on the Drawings or directed by the Engineer, and shall furnish all necessary equipment and materials required to complete the connection.

B. Compression Coupling for Non-Pressure Pipe:

1. When joining different types of pipe together or new pipe to existing pipe, the Contractor shall use Fernco Compression Couplings, or equal, that are resistant to corrosion by soil and sewage and that will provide a permanent watertight joint.

2. The compression coupling shall meet the physical test and joint-leak requirements specified in ASTM C425. The bands for attaching pipes shall be stainless steel conforming to ASTM C425. Each coupling shall bear the manufacturer's name an indication of its size.

C. Couplings and Adaptors

1. Flexible couplings shall be of the sleeve type with a middle ring, two wedge shaped resilient gaskets at each end, two follower rings, and a set of steel trackhead bolts. The middle ring shall be flared at each end to receive the wedge portion of the gaskets. The follower rings shall confine the outer ends of the gaskets, and tightening of the bolts shall cause the follower rings to compress the gaskets against the pipe surface, forming a leak-proof seal. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at

rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

2. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

3. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings:

4. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe-

Dresser	Rockwell
Style 138	411

5. Transition couplings for joining pipe of different outside diameters-

Dresser	Rockwell
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")

6. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Rockwell
Style 128 steel (3"-48" C.I. Pipe)	912 cast (3"-12")
Style 128 steel (2"-96" steel pipe)	913 steel (3" and larger)

2.06 INSULATION AND HEAT TRACING FOR BURIED PIPING

A. Where noted on the Contract Drawings, buried piping shall be insulated or insulated and heat traced. Insulation for buried piping shall be Pittsburgh “Foamglass” or equivalent rigid glass foam insulation, minimum 1” thick. Insulation halves shall be closed around pipe with self-sealing jacket flap. Each SECTION shall be circled with minimum three loops stainless steel wire. SECTIONs shall be tightly butted together and sealed with 3M vinyl pipe wrap tape. This shall be followed by a continuous spiral wrap of 3M vinyl pipe wrap tape with overlap as recommended by the manufacturer.

B. Heat tracing system shall be as specified in Division 15, Thermal Insulation, suitable for use on metal or plastic buried piping and for a temperature range of 40 degrees to 120 degrees. Components of the heat tracing system shall be coordinated as to type, wattage and quantity of cables, type and thickness of insulation and type and diameter of buried pipe, per manufacturer’s recommendations.

2.07 CONCRETE THRUST BLOCKS, CRADLE, ANCHORS OR ENCASEMENT

A. Concrete thrust blocks, cradle, anchors or encasement shall be placed where shown on the Drawings, required by the Specifications, or as directed by the Engineer.

B. For cradle and encasement, concrete shall be 3000 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed.

C. For thrust blocks and anchors, concrete shall be 3000 psi, and shall be formed or be sufficiently stiff to maintain the forms indicated on the Details.

D. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. Concrete placed outside the specified limits or without authorization from the Engineer will not be subject to payment.

E. Water mains and force mains shall have concrete thrust or “kicker” blocks at all pipe interSECTIONs and changes of direction to resist forces acting on the pipeline. All reducers (increasers) shall be anchored.

PART 3 - EXECUTION

3.01 EXCAVATION FOR PIPELINE TRENCHES

A. Trenches in which pipe is to be laid shall be excavated in accordance with SECTION 312000 to the depths shown on the Drawings or as specified by the Engineer. Minimum cover for all water lines shall be 2 feet 6 inches. Yard piping may not be depicted in profile; Contractor shall furnish and install all vertical alignment fittings required to construct piping to elevations shown on the Contract Drawings.

3.02 PIPE BEDDING

A. Pipe bedding material and methods shall be in accordance with the Trenching and Bedding Detail on the Standard Detail Drawing for all site piping except water mains, chlorine solution lines and sewage force mains which may also be bedded on select earth.

3.03 PIPE JOINTING

A. The cleaning and assembly of pipe and fitting joints shall be in accordance with the manufacturer's recommendations.

3.04 BACKFILLING PIPELINE TRENCHES

A. Backfilling of pipeline trenches shall be accomplished with the requirements set forth in SECTION 02226 and as shown on the Drawings.

B. Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction.

C. In the event that pavement is not placed immediately following trench backfilling in paved areas, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

D. Method and type of backfill shall be in accordance with the Standard Details in the Contract Drawings.

3.05 TESTING

A. Pressure Piping (Liquids)

1. All pressure piping (lines not laid to grade) shall be given a hydrostatic test of at least 1.5 times the normal operating pressure of the pipe (at its lowest elevation), but not to exceed the rated working pressure of the pipe or valves. Note: Engineer shall verify test pressure. Loss of pressure during the test shall not exceed 0 psi in a 4 hour period and 5 psi in a 24 hour period. Any test results that do not meet either of these requirements shall constitute a failure of the pressure test.

2. Contractor shall furnish a recording gauge and water meter for measuring water used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall be turned over to the Engineer at conclusion of test. The pressure recording device shall be suitable for outside service, with a range from 0-200 psig, 24-hour spring wound clock, designed for 9" charts, and shall be approved by the Engineer.

3. Pipelines shall be tested before backfilling at joints except where otherwise required by necessity or convenience.

4. Duration of test shall be not less than four (4) hours where joints are exposed and not less than 24 hours where joints are covered.

5. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be laid and leakage must be minimized, regardless of total leakage as shown by test.

6. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at no additional expense to the Owner.

7. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

8. Where nonmetallic joint compounds are used, pipelines should be held under normal operating pressure for at least three days before testing.

9. The Owner will provide initial water for testing and disinfecting the pressure piping. Should the first test fail to pass, all additional water required for subsequent tests shall be furnished at the Contractor's expense.

10. The cost of testing pressure piping is to be included in the Contractor's lump sum Contract Price.

B. Non-Pressure Piping (Sewers)

1. Pipe laid to grade shall be visually inspected by the Engineer from the outside before backfilling and from manhole (or headwall) for trueness of lines and grade and integrity of joints.

2. After non-pressure lines or system have been brought to completion, and prior to final inspection, the Contractor shall rod out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal from the lines of any and all dirt, debris and trash.

3. During the final inspection, the Engineer will inspect each individual line, from manhole to manhole, either by use of lights or other means at his disposal to determine whether the completed lines are true to line and grade as laid out or as shown on the Drawings.

4. All lines or SECTIONs of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking SECTIONs of pipe, or are obstructed in such a manner that they cannot be satisfactory corrected otherwise, shall be removed and replaced at no additional expense to the Owner.

5. The infiltration of groundwater or exfiltration of sewage from the sanitary sewer system will be limited to 50 gallons per inch diameter per mile per day. This limitation is inclusive of manholes, sewers, and appurtenances.

6. Should visible leaks be observed in the sanitary sewer system, the Contractor shall conduct the infiltration or exfiltration test upon the discretion of the measurements to determine quantities of any possible infiltration, with measurements taken at locations directed by the Engineer.

7. Exfiltration tests shall be made on each SECTION of pipe between manholes after it has been laid but prior to backfilling of joints. Exfiltration test shall be conducted by plugging the lower end of the SECTION of the sewer to be tested and filling the sewer to a point approximately five feet above the invert at the lower end and at least one foot above the invert at the upper end, observing for leakage at all joints and measuring the amount of leakage for a given interval of time. Exfiltration shall not exceed 110 percent of the infiltration limits set out hereinbefore. All observed leaks shall be corrected even though exfiltration is within the allowable limits.

3.06 CLEAN UP

A. Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

3.07 DISINFECTION OF POTABLE WATER LINES

A. The new potable waterlines shall not be placed in service--either temporarily or permanently--until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the Engineer.

B. After testing, a solution of hypochlorite using HTH or equal shall be introduced into the SECTION of the line being disinfected sufficient to insure a chlorine dosage of at least 50 ppm in the main. While the solution is being applied, the water should be allowed to escape at the ends of the line until tests indicate that a dosage of at least 50 ppm has been obtained throughout the pipe. Open and close all valves and cocks while chlorinating agent is in the piping system. The chlorinated water shall be allowed to remain in the pipe for 24 hours, after which a residual of at least 25 ppm shall be obtained. The disinfection shall be repeated until 25 ppm is obtained after which time the main shall be thoroughly flushed until the residual chlorine content is not greater than 1.0 ppm, and then may be connected to the system. Also, no additional payment will be allowed for providing taps for chlorine injection and/or flushing, if necessary.

END OF SECTION

SECTION 02621

YARD VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all valves shown on the Drawings and/or specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification SECTIONs, apply to work of this SECTION.

B. Piping is specified in Division 02 Specification SECTIONs.

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering. Comply with provisions of SECTION 01300.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 GATE VALVES

A. Gate valves shall conform with AWWA C-509 standard, and shall be of the resilient seat type, iron body, fully bronze mounted, non-rising stem and have a design working pressure of 250 psi. All assembly bolts shall be stainless steel. Valves shall be of standard manufacturer and of the highest quality both as to materials and workmanship.

B. All gate valves shall be furnished with mechanical joint connections, unless otherwise shown on the Drawings or specified hereinafter.

C. An epoxy coating conforming to AWWA C-550 shall be applied to the interior and exterior ferrous surfaces of the valve except for finished or seating surfaces.

D. All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve.

E. Gate valves 12” and smaller shall be installed in a vertical position. Gate valves greater than 12”shall have the bonnet mounted in the horizontal position and have a bevel gear actuator. Gate valves shall be provided with a 2-inch square operating nut and shall be opened by turning to the left (counter-clockwise). All valve operating nuts shall be set within a cast iron valve box. There shall be a maximum 48" depth of valve operating nut. Contractor must use extension stems, if necessary, to raise operator nut within 48" of final grade.

2.02 PLUG VALVES

A. All plug valves shall be eccentric plug valves unless otherwise specified.

B. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-64, grooved ends per AWWA C606-87. Screwed ends shall be to the NPT standard.

C. Valve bodies shall be flushing body type and made of ASTM A126 Class B cast iron. Valves shall be furnished with a 1/8" welded overlay seat of not less than 95% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

D. Plugs shall be made of ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.

E. Valves shall have replaceable sleeve type bearings and grit seals at the upper and lower journals.

F. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

G. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.

H. Buried valves shall be manually operated with 2-inch square operating nuts in vertical position for use in a valve box unless otherwise indicated on the plans. Buried valves shall have extension stems that bring the 2-inch square operating nut to within 2 feet of finished grade. Each buried valve shall be supplied with a two (2) T-handle wrenches that allow the valve to be operated with the T- handle at waist height. All valves 6-inch and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft shall be stainless steel and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts, washers and appurtenances shall be stainless steel.

I. Valves and gear actuators for buried or submerged service shall have seals for all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs, washers and appurtenances shall be stainless steel.

J. Cylinder actuators shall be equipped with a 2-inch operating nut to allow manual valve operation in case of supply failure.

K. Valves shall provide drip tight shutoff up to the full pressure rating. Valves shall be provided with adjustable limit stops and rotate 90 degrees from fully opened to fully closed.

L. Valves shall have rectangular port openings for throttling service, and shall open to 100% of the corresponding pipe diameter.

M. All buried service plug valves shall have mechanical joint ends and have all exterior surfaces shop painted with two coats of Fed. Spec. TT-C-494A Asphalt Varnish.

N. All valves and actuators shall be as manufactured by DEZURIK or approved equal.

2.04 GATE VALVES - BURIED

A. Gate valves shall conform to the Specifications of SECTION 331216, Paragraph 2.01, except be designed for buried service, have mechanical joint ends, have all exterior surfaces shop painted with two coats of Fed. Spec. TT-V-51F Asphalt Varnish, with 2-inch square nut operator in a vertical position for use in a valve box.

2.05 BUTTERFLY VALVES

A. All butterfly valves shall be of the tight closing, rubber seat type with Buna-N rubber seats, which are recess mounted and securely fastened to the valve body or to the valve disc. Seating surfaces shall be stainless steel. Valves shall be rated for 150 psi pressure (Class 150B) and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves shall meet the full structural requirements of the application class of AWWA C504-87.

B. Valve bodies shall be constructed of cast iron ASTM A126, Class B and shall have integrally cast mechanical joint ends. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be strictly in accordance with AWWA C504. Valve shafts shall be constructed of 18-8 stainless steel or of approved construction.

C. Disc shall be constructed of any material described in AWWA C504, Section 3.4. All disc seating edges shall be smooth and polished. Valve shafts shall be a one piece unit extending full size through the valve disc and bearings or a two piece unit (stub-shaft type). Disc mounted seats shall be mechanically retained; body mounted seats shall be bonded to the valve body. Bonded-in seats must be simultaneously molded in, vulcanized and bonded to the body and the seat. Bearings shall be corrosion resistant and self-lubricating:

D. Operator shall be the traveling nut type, AWWA C504, Class 150.

E. All operators shall be fully gasketed and grease packed and designed to withstand submersion in water to 10 psi. Valve shall open with a counterclockwise rotation of the operator, and operation shall closely resemble conventional distribution valve practice and shall minimize water hammer. Operator shall be equipped for buried service.

F. Butterfly valves shall be supplied for mains 14" and larger where shown on the Plans.

G. All surfaces of the valve shall be clean, dry and free from grease before painting. An epoxy coating conforming to AWWA C550 shall be factory applied to the interior and exterior ferrous surfaces of the valve except for finished or seating surfaces.

H. Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C504, Section 5.

I. Butterfly valves installed in the ground shall have the operator nut in a vertical position for use in a roadway type valve box.

J. There shall be a maximum 48" depth to valve operator nut. Contractor must use extension stems, if necessary, to raise operator nut within 48" of the final grade.

K. Butterfly valves shall be sized as shown on the Drawings

2.06 VALVE BOXES - BURIED VALVES

A. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "WATER", "SEWER", "DRAIN", as applicable. Valve boxes for gate valves larger than 8 inches shall be three-piece. Valve boxes shall be accurately centered over valve operating nut, and backfill thoroughly tamped about them. Valve boxes shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be at grade in any paving, walk or road surface, and in grass plots, fields, woods or other open terrain. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry, Bingham & Taylor, or equal.

B. Wherever valve boxes fall outside of the pavement, the top of the box shall be set in a cast-in-place concrete slab 18” x 18” x 4” thick with the top of the slab and box flush with the top of the ground. This provision shall apply to all new and all existing valve boxes which fall within the limits of the contract, unless otherwise stated on the plans or ordered by the Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with details on the Contract Drawings and with the manufacturer's recommendations.

B. All valves shall be anchored in accordance with the details on the Contract Drawings.

- END OF SECTION -

SECTION 02645

HYDRANT ASSEMBLY

PART 1 - GENERAL

1.01 SCOPE

The Contractor shall furnish and install, where shown on the plans and additional locations as directed by the Owner, hydrant assemblies and blow-hydrants manufactured and equipped as described below.

PART 2 - PRODUCTS

2.01 FLUSHING HYDRANT ASSEMBLY

A. Hydrants shall conform in all respects to the requirements of AWWA C502. All hydrants shall have 6-inch mechanical joint shoe connection, two (2) 2-1/2" hose outlets, one (1) 4-1/2" pumper nozzle with caps. Connection threads and operation nuts shall conform to National Standard Specifications as adopted by National Board of Fire Underwriters. The hydrant shall be equipped with safety flanges designed to prevent barrel breakage when struck by a vehicle and an auxiliary gate valve.

B. Each hydrant shall be fully bronze mounted with the main valve having a threaded bronze seat ring assembly of such design that it is easily removable by unscrewing from a threaded bronze drain ring. Bronze drain ring shall have multiple ports providing positive automatic drainage as the main valve is opened or closed. Drainage waterways shall be completely bronze to prevent rust or corrosion.

C. Operating stems shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stops shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir protected from weather and the waterway with O-ring seals.

D. Hydrants shall be designed for 250 psi working pressure and shop tested to 1250 psi pressure with main valve both opened and closed. Under test the valve shall not leak, the automatic drain shall function and there shall be no leakage into the bonnet. Hydrants shall have a UL/FM approved rating.

E. Each hydrant shall be installed with an auxiliary shut-off valve and valve box; valve box cover shall be marked "WATER" as required. Hydrants shall be secured to the shut-off valve by AWWA approved restraint joints, rodding with four (4) equally spaced all thread rods and "Duc-Lugs", or other equally approved method.

F. Inlet cover depth shall be 36" and the minimum dimension from ground to centerline of lowest opening shall be 18". Hydrants shall be supported on a poured-in-place concrete thrust block and provided with a drainage pit as indicated on Standard Detail Sheet.

G. All hydrants shall receive two (2) field coats of Koppers Company, Inc. Glamortex enamel (red). The Owner shall be furnished with two (2) hydrant barrel wrenches, four (4) spanner wrenches and two (2) operating nut wrenches.

H. Below ground hydrants shall be flush type with the upper barrel and nozzles contained in a cast iron box with a non locking lid.

I. *SEE SECTION 01600 MATERIAL AND EQUIPMENT* for APPROVED MANUFACTURE

J. Hydrant assemblies shall include the isolation valve and both valve and hydrant shall have a UL/FM approved rating.

2.02 UNDERGROUND BLOW-OFF ASSEMBLY

A. Blow-off hydrants shall be of non-freezing, self-draining type, with an overall length of 30". Set underground in a 30" meter box, these hydrants will be furnished with a 2⅛ " Main Valve Opening inlet, a non-turning operating rod, 7/16 inch square operating nut, and shall open to the left. All of the working parts shall be of bronze-to-bronze design, and be serviceable from above grade with no digging. The outlet shall also be bronze and be 2-1/2" NST. Hydrants shall be lockable to prevent unauthorized use. *SEE SECTION 01600 MATERIAL AND EQUIPMENT* for APPROVED MANUFACTURE.

B. The Contractor shall furnish two (2) T-operating wrenches in the lengths necessary to operate the blow-off hydrants for an operator of average height in a normal working position.

2.02 BLOWOFF HYDRANT ASSEMBLY

A. 3-inch Hydrants shall be self-draining, non-freezing, compression type with 2⅛" main valve opening. Inlet connection shall be MJ. Outlet shall be 2" IP. Hydrants shall be post type *SEE SECTION 01600 MATERIAL AND EQUIPMENT* for APPROVED MANUFACTURE.

B. Hydrants shall have a ductile iron pipe riser with a cast iron stock top, and non-turning operating rod. Principal interior operating parts shall be brass and removable from the hydrant for servicing without excavating the hydrant.

C. Flushing assembly installation shall also include all excavation, backfill, thrust blocking, and #9 crushed stone.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Hydrants shall be located as shown on the drawings unless otherwise specified by the Owner. Each hydrant shall be connected to the main with a 6-inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway and the cast-iron valve box set flush with the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished gradeline immediately after installation to obtain beneficial use of the hydrant as soon as practicable. All hydrants shall be provided with a shut-off valve in the hydrant lateral as shown. All hydrants shall be installed in accordance with the manufacturer's directions and as detailed on the Contract Drawings.

B. Blow-off hydrants shall be located as shown on the drawings unless otherwise specified by the Utility. Each blow-off hydrant shall be connected to the main with at least as much cover as the distribution main. Blow-off hydrants shall be set plumb with nozzle facing the roadway and with the box cover set flush with the finished surrounding grade. The backfill around each hydrant shall be thoroughly compacted to the finished gradeline immediately after installation to obtain beneficial use of the hydrant as soon as practicable. All blow-off hydrants shall be provided with a shut-off valve in the lateral as shown.

- END OF SECTION -

SECTION 02700

SITE RESTORATION

PART 1 - GENERAL

1.01 CLEAN-UP

A. Upon completion of the work under this Contract, the Contractor shall remove all debris and surplus construction materials resulting from his work. The Contractor shall grade the ground along each side of the pipe trench and/or structure in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

PART 2 - PRODUCTS

2.01 SEEDING

A. All graded areas shall be seeded at the rate of six (6) pounds of seed per 1,000 square feet. The mixture shall consist of:

Kentucky 31 Fescue	60%
Creeping Red Fescue	20%
Annual Rye Grass	20%

B. After seed has been distributed, the Contractor shall cover areas with straw to a depth of 1-1/2". Any necessary re-seeding or repairing shall be accomplished by the Contractor before final acceptance. Seeding is not a pay item.

PART 3 - EXECUTION

3.01 SITE RESTORATION

A. After installation of water lines, the construction site will be restored to its original condition or better. All paved streets, roads, sidewalks, curbs, etc. removed or disturbed during construction shall be replaced, and all materials and workmanship shall conform to standard practices and specifications of the Owner, and/or to the Kentucky Department of Highways requirements, and specifications, whichever applies. Gravel, cinder or dirt streets, drives and shoulders shall be replaced and sufficiently compacted to provide a surface suitable for carrying the type of traffic normally imposed at the location.

B. All seeded areas shall be watered daily during the germination period, unless rain supplies the required moisture. The Contractor shall replace, at his own expense, trees, shrubs, etc. disturbed during construction.

C. The Contractor shall remove from the site all equipment, unused materials and other items at his expense. The construction site shall be left in a neat, orderly condition, clear of all unsightly items, before the Work is finally accepted.

- END OF SECTION -

SECTION 02830

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and erect the chain link fence and gates as indicated on the Drawings and as herein specified.

B. The chain link fence shall have a top rail and bottom tension wire.

C. The chain link fence materials and installation shall meet or exceed the standards of the Chain Link Fence Manufacturers Institute, New York, N.Y., except as otherwise specified in this section. Also, fence materials shall meet or exceed Fed. Spec. RR-F-191H/GEN for Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories), and shall conform to the ASTM Standard Specifications hereinafter noted.

D. Fence framework, fabric, and accessories.

E. Excavation for post bases.

F. Concrete anchorage for posts.

G. Manual gates and related hardware.

1.02 RELATED WORK

A. Division 3 – Concrete

B. Section 16741 – Security Gate Video Intercommunication System

1.03 REFERENCES

A. ANSI/ASTM A123 - Zinc (Hot Galvanized) Coatings of Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips

B. ANSI/ASTM F567 - Installation of Chain Link Fence

C. ASTM A120 - Pipe, Steel, Black and Hot-dipped Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses

D. ASTM C94 - Ready-Mixed Concrete

E. FS RR-F-191 - Fencing, Wire and Post, Metal, Type I or Type II

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in commercial quality chain link fencing with two (2) years experience.

B. Installation: ANSI/ASTM F567.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01300. Complete wiring diagrams shall be included.

B. Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

D. Submit samples under provisions of Section 01300.

E. Submit the following samples illustrating each fence material and fabric finish.

1. A 2-inch length of each type of post.
2. A 2-inch length of each type of brace and railing.
3. A 2-inch length of framework for gates.
4. A 2-inch length of diagonal truss brace.
5. A 2-inch length of tension wire.
6. Each type of fitting used at terminal posts.
7. Fittings used at line posts.
8. Fittings for the gate leaf frame.
9. Gate hinge.
10. Gate latch.
11. Stretcher bar, 2-inch length.
12. Bolt and nut fastener.
13. Fence fabric, two (2) weaves, two (2) meshes long.
14. Tie.

F. Accompanying the samples, the Contractor shall submit two statements, one on his and one on his subcontractor's letterhead stating that the samples submitted comply with the requirements of these Contract Documents. Samples shall be submitted for review at least 30 days before fence erection.

1.06 AMERICAN IRON AND STEEL

Under the 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 applies to American Iron and Steel requirement to this project. All listed iron and steel products used in this project must be produced in the United States.

PART 2 - PRODUCTS

2.01 MATERIALS

Framework: ASTM A120; Schedule 40 steel pipe, standard weight, one piece without joints.

2.02 CONCRETE MIX

A. Concrete: As specified in Section 03300.

B. Concrete: ASTM C94; Portland Cement; 2500 min. psi at 38 days; 3-inch slump/1-inch maximum sized aggregate.

2.03 COMPONENTS

A. Type I metal fittings, posts, fence, and gate framework, and all accessories shall be galvanized with a heavy coating of 1.8 oz. pure zinc spelter per square foot of surface area to be coated using the hot-dip process. Type II shall be triple coated with 102 zinc, 15 MG of chromate and 0.3 mils cross link polyurethane.

B. All fabrication and welding shall be done before hot-dip galvanizing. All welding shall conform to the American Welding Society standards.

C. The chain link fence fabric shall be galvanized steel chain link fabric conforming to ASTM Standard Specification for Zinc-Coated Steel Chain Link Fence Fabric, Designation A392-74, with Class 2 zinc coating (2.0 oz. of zinc per square foot of uncoated wire surface). The fabric shall be woven in 2-inch mesh from No. 9 gauge wire in a 7-foot width with barbed selvages top and bottom.

D. The barbed wire shall be galvanized steel barbed wire consisting of two strands of twisted No. 12 1/2-gage wires with 4-point barbs spaced three (3) inches apart and conforming to ASTM Standard Specification of Zinc-Coated (Galvanized) Steel Barbed Wire, Designation A121-77, with Class 3 zinc coating (minimum of 0.80 oz. of zinc per square foot of uncoated wire surface for No. 12 1/2-gauge wire).

E. The tension wire shall be No. 7-gauge coil spring steel wire with galvanized finish having minimum of 0.80 oz. of zinc coating per square foot of uncoated wire surface.

F. Tie wires for fastening fence fabric to line posts and rails shall be not less than No. 6 gauge aluminum wire.

G. Line posts shall be 2-3/8-inch (2.375") outside diameter steel pipe weighing not less than 3.65 lb. per ft. for Type I or 3.117 lb. per ft. for Type II, or 1^{7}/8-inch high carbon steel H-beams weighing not less than 2.70 lb. per ft.

H. End, corner, and pull posts shall be 2-7/8-inch (2.875) outside diameter steel pipe weighing not less than 5.79 lb. per ft. for Type I or 4.64 lb. per ft. for Type II, or 2½-inch square steel tube weighing not less than 5.14 lb. per ft., or 3½-inch by 3½-inch roll-formed steel corner section weighing not less than 5.14 lb. per ft.

I. Gate posts for gate leaves up to and including six (6) feet wide shall be 2^{7}/8-inch outside diameter steel pipe weighing not less than 5.79 lb. per ft., or 2½-inch square steel tube weighing not less than 5.14 lb. per ft., 3½-inch by 3½-inch roll-formed steel corner section weighing not less than 5.14 lb. per ft.

J. Gate posts for gate leaves over six (6) feet wide and up to and including 13 feet wide, shall be 4-inch outside diameter steel pipe weighing not less than 9.10 lb. per ft. for Type I or 3½-inch Type II at 5.71 lb. per ft.

K. Top railings and railings for top, middle, and bottom braces between terminal posts and adjacent line posts shall be $1^{5}/8$-inch outside diameter steel pipe weighing not less than 2.27 lb. per ft., or $1^{5}/8$-inch by 1¼-inch 14-gauge roll-form section.

L. Diagonal truss braces between terminal and adjacent line posts and for gate framework shall be 3/8" diameter steel rod.

M. Barbed wire support arms shall project outward from the top of the posts at 45 degrees and shall be capable of withstanding a 200-pound downward pull on the outermost end of the arm, without failure. The arms shall have provision for the attachment of three (3) strands of evenly spaced barbed wire. Arms shall be integral with post top weather caps having holes for the passage of the top rail at intermediate posts.

N. Fittings shall be heavy duty malleable iron or pressed steel of suitable size to produce strong construction.

O. Stretcher bars for attaching fabric to terminal posts such as end, corner, pull, or gate posts and gate frames, shall be flat bars with minimum cross-section dimensions of not less than 1/4" by 3/4". The stretcher bars shall be the full height of the fabric and shall be secured with bar bands of not less than 11-gauge sheet steel, spaced approximately 15 inches on centers and bolted with 3/8-inch diameter bolts.

P. Gate leave framework shall be $1^{7}/8$-inch outside diameter steel pipe weighing not less than 2.72 lb. per ft. for Type I or 2.28 lb. per ft. for Type II.

Q. If bolted or riveted corner fittings are not used, the gate frame shall be hot-dip galvanized after welding.

R. Gate hinges shall be of heavy pattern of adequate strength for the gate size with large bearing surfaces for clamping or bolting in position.

S. The gates shall be provided with a suitable latch accessible from both sides and with provision for padlocking.

T. Double leaf swing gates shall have a center bolt, center stop, and automatic backstops to hold leaves in open position.

U. Gate padlocks shall have solid brass cases, hardened steel shackles, removable core cylinders, and galvanized steel chains attached to the shackle by a clevis. Padlocks shall be manufactured by Eaton Corp. Lock & Hardware Div., of Emhart Corp., Berlin, Conn.; Best Universal Lock Co., Inc., Indianapolis, Ind.; or be an acceptable equivalent product. The padlocks shall be furnished with two (2) keys each.

2.04 FINISHES

A. Galvanized: ANSI/ASTM A120; 1.8 oz./sq. ft. coating and 22 mils of black PVC coating, Bonded to Core Wire.

B. Accessories: Same finish as framing and fabric.

2.05 AUTOMATIC CANTILEVER SLIDE GATE OPERATOR

A. A pre-wired, self-contained, slide gate operator for horizontal sliding gates, including all selected attachments and accessory equipment, shall be provided for where shown on the drawings.

B. Operation shall be by means of a metal rail passing between a pair of hydraulically driven solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, gear roller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 1000 pounds. Gate panel velocity shall not be less than 1.0 feet per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly.

C. Standard mechanical components shall include as a minimum:

1. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 1-1/2" bronze bearing surface, acting on arm pivot pins. (item 2 below)

2. Arm pivot pins: 3/4" diameter, stainless steel, with integral tabs for ease of removal.

3. Tension spring: 2-1/2" heavy duty, 800-pound capacity.

4. Tension adjustment: Finger tightened nut, not requiring the use of tools.

5. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.

6. Limit switches: Fully adjustable, toggle types, Nema 4.

7. Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.

8. Chassis: 1/4" steel base plate, and 10 Ga. sides and back welded and ground smooth.

9. Cover: 16GA. galvanized sheet metal with a powder paint finish. All joints welded, filled and ground smooth. Finished corners square and true with no visible joints.

10. Finish: Fully zinc plated then finish coat of high gloss powder paint withstanding 1000-hour salt spray test.

11. Drive wheels: 6" Dia. Metal hub with polyurethane tread.

12. Drive rail: Shall be extruded 6061 T6, not less than 1/8" thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.

13. Hydraulic hose: Shall be 1/4" synthetic, rated to 2750 p.s.i.

14. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.

15. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.

16. Hydraulic fluid: High performance type with a viscosity index greater than 375.

17. A zero to 2000-PSI pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.

18. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

19. A cabinet lock for the operator cover.

20. A lockable remote release device that allows the release of the grip of the slide gate rail without removing the operator cover.

D. Minimum standard electrical components:

1. Motor: Shall be a 1 HP, 56C, TEFC, continuous duty motor, with a service factor of 1.15, or greater, 208V, single-phase.

2. All components shall have overload protection.

3. Transformer: 75 VA, non-jumpered taps, for all common voltages. Control circuit: 24VDC.

E. The gate operator shall come equipped with the following external sensors being capable of opening and/or reversing the gate in either direction upon sensing an obstruction.

1. The gate operator shall be capable of accepting a discrete input from the security access system to open the gate.

2. A "Torque Sensor" utilizing internal sensing devices to detect on object when encountered by the closing gate and reversing the gates direction.

3. An adjustable timer that signals the operator to close the gate after a prescribed set point.

4. Photobeam obstruction detection compliant with UL325.

F. The gate operator control board shall have a minimum of two ports for plug in loop detectors. Loop wiring shall be provided for inside and outside safety loops as well as an exit loop. The loop detectors shall plug into the ports on the control board. The loop detectors shall be installed "in-ground" and located per manufacturer's recommendation. When the loop detector for the gate operator that operates on "exit" senses traffic, the slide gate shall open automatically. Safety loops shall allow the gate to stay open when vehicles are obstructing the path.

G. Provide a five-year limited warranty against all defects in materials or workmanship. Defective materials shall be replaced with comparable materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner.

H. Automatic Slide Gate Operators shall be as manufactured by SlideDriver model 15 or equal and shall include all options necessary to meet all of the requirements noted below.

I. Slide Gate operators shall be microprocessor based. An operator shall be provided for each plant entrance gate, with a solid state board on each operator to control all functions of the operator as described in this specification section. Provide all necessary boards, power supplies, special mounting hardware, connectors, cables, wiring and accessories for a complete operational system.

J. Each operator shall be capable of operating a 30-foot gate. Each gate operator assembly shall include a 1 HP continuous duty motor rated for 208 V single-phase AC supply only.

K. The primary reduction and power transfer for each gate operator shall be provided by a single cog belt drive train and worm gear reduction. A harmonic linkage arm shall function from the bottom of the gate operator and shall start the gate slowly, accelerate through the cycle, then slow down prior to stopping to prevent the gate from bouncing.

L. The gate operator shall have a "tamper detect" function that shall start the motor to re-close the gate if the gate is forced open without an authorized command. Functions shall be user-programmable by DIP-switches located on control board.

M. If an obstruction is met during the opening or closing cycles, the gate operator shall have the ability to automatically reverse the gate. This reverse system shall be an inherent function for the gate operator so that if the external reverse devices fail or become inoperative, the operator will still sense the obstruction and reverse the gate. The inherent reverse system shall consist of a primary system that reverses the gate if an obstruction is sensed. Should the primary system fail or become inoperative, a secondary inherent system shall sense the obstruction and reverse the gate. The primary system shall sense a clutch slippage and reverse the gate. Should the clutch fail to slip, the secondary system shall sense a stoppage and reverse the gate.

N. The gate operator shall have the capability to stop and activate the internal alarm upon sensing an entrapment (two sequential activations of the inherent sensing system) and shall require activation of the reset switch prior to returning to normal operation, as required by UL 325 safety standard. For enhanced safety, the operator shall upon sensing an entrapment, release pressure on the gate and assume a fail-safe condition to allow any entrapment the opportunity to free itself without the need for outside intervention.

O. The gate operator shall incorporate a "fail-safe" design that shall allow the manual operation of the gate from the inside without the need for any hand cranks, keys or mechanical devices. The manual release device shall be an integral (non-removable) part of the operator. The manual release or manual operation of the gate shall not result in a risk of injury to users if the operator is activated while the manual release is activated or being used.

P. The gate operator shall be in compliance with UL Standards for safety – Door, Drapery, Gate, Louver and Window Operators and systems; UL 325 (fourth edition); UL Standards for safety – Tests for Safety Related Controls Employing Solid State Devices, UL 991 (second edition).

Q. Contractor's submittals for the gate operator shall include an equipment list, data sheets, system description, block diagrams on equipment and electrical wiring diagrams for installation. The submittal shall include all data required to evaluate design, quality and configuration of the gate operator system.

R. Factory Warranty period for the gate operators shall be a minimum of two (2) years parts and workmanship.

PART 3 - EXECUTION

3.01 INSTALLATION - ERECTION OF CHAIN LINK FENCE

A. The fence and gates shall be erected by skilled mechanics.

B. Post spacing shall be uniform with maximum spacing of 10 feet in fences erected along straight lines. All posts shall be placed plumb and centered in the concrete foundations.

C. Post foundations in earth shall be concrete cylinders with a minimum diameter of 12 inches, crowned at grade to shed water, and shall not be less than 36 inches deep in the ground. Posts shall be set in the full depth of the foundations except for six (6) inches of concrete under the posts.

D. If foundation holes are excavated in peat or other unstable soil, the Engineer shall be notified for determination of suitable construction precautions.

E. If solid ledge is encountered without overburden of soil, posts shall be set into the rock a minimum depth of 12 inches for line posts and 18 inches for terminal posts. Post holes shall be at least one (1) inch greater in diameter than the post and the grout shall be thoroughly worked into the hole so as not to leave voids, and shall be crowned at the top to shed water. Where solid rock is covered by an overburden, the total setting depths shall not exceed the depths required for setting in earth, and the posts shall be grouted into the rock as described.

F. Any change in direction of the fence line of 30 degrees or more shall be considered corners. Pull posts shall be used at any abrupt change in grade.

G. Maximum area of unbraced fence shall not exceed 1,500 square feet.

H. Terminal posts shall be braced to adjacent posts with horizontal brace rails and diagonal truss rods brought to proper tension so that posts are plumb.

I. There shall be no loose connections or sloppy fits in the fence framework. The fence framework shall withstand all wind and other forces due to the weather.

J. Fabric shall be stretched taut and tied to posts, rails, and tension wires with the bottom edge following the finished grade not more than two (2) inches above the grade. The fabric shall be installed on the security side of the fence and shall be anchored to the framework so that the fabric remains in tension after pulling force is released. The fabric shall be attached to line posts with ties spaced at not more than 15-inch intervals and to rails and braces at not more than 24-inch intervals. The fabric shall be attached to the tension wire with hog ring ties on 24-inch centers.

K. Three strands of barbed wire shall be installed on each extension arm of the line fence and at the top of each gate. The wires shall be pulled taut and fastened at each support.

L. Gates shall be installed plumb, level, and secure for the full width of the opening and the hardware adjusted for smooth operation. Provide concrete center drop to foundation depth and drop rod retainers at center of double gate openings.

- END OF SECTION -

SECTION 03030 – STRUCTURAL EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Structural Excavation and Backfill includes:

1. Preparing subgrades for slabs on grade.
2. Excavating and backfilling for building/strucure foundations from subgrade.
3. Over-excavation and structural backfill to achieve adequate support for foundations.
4. Subsurface drainage backfill for foundation walls.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Structural Special Inspection.”
2. Division 1 Section "Temporary Facilities and Controls."
3. Division 3 Section "Cast-in-Place Concrete."
4. Division 31 Section "Dewatering."
5. Division 31 Section "Excavation Support and Protection."
6. Division 31 Section “Earth Moving.”
7. Division 31 Section “Aggregate Pier Soil Improvements.”
8. Division 31 Section "Micropiles & Rock Anchors.”

1.3 PAYMENT

A. General:

1. No additional compensation will be made for excavation and engineered backfill where work was not based on the inspection and recommendation of the Special Inspector. All quantities for unit price or other contract adjustment must be recorded by the Contractor and verified by the Special Inspector daily.
2. Depth to achieve adequate support for bearing foundations and slab on grade will be determined by the Special Inspector (not Contractor) during the construction operations.
3. No payment will be made for rejected work.
4. All overexcavation of soft and/or saturated soils caused by dewatering/rainwater control practices and wet/freezing weather, excavation of soils into mass undercut or mass fill performed as part of this Construction Project, and subsequent backfill, as directed by Special Inspector shall be performed at no additional cost to Owner. Contractor shall notify Construction Manager of work required, perform work where directed by Construction Manager, and coordinate with other trades who may be required to perform such work.
5. Any adjustments for payment to the base bid for excavation (Standard vs Special) shall be process and material dependent, not elevation dependent.
6. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.

c. 24 inches below bottom of footings where footings are specified to be soil-bearing.
d. 6 inches outside of minimum required dimensions of concrete cast against grade.
e. 6 inches beneath bottom of concrete slabs-on-grade.

B. Overexcavation and Backfill Basis of Bids:

1. Base bids on contractor's estimation of quantities using the geotechnical investigation report as a reference document which is available to bidders, but which is not part of the contract documents. The depth to achieve adequate bearing may vary and shall be discerned by the Contractor using the Geotechnical Report, their knowledge of the site, and any investigation they perform during the bid process. The Architect and Structural Engineer are not responsible or liable for the accuracy of the information presented in the Geotechnical Report. All interpretation and bid quantities are the sole risk of the Contractor.

C. Overexcavation and Backfill Basis of Payment:

1. Payment for overexcavation and engineered backfill to achieve adequate bearing for foundations and slabs will be made on a lump sum basis. Quantity estimation and bid amount is the sole responsibility of the bidding Contractor.

a. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
b. Should the Contractor affirm that the Geotechnical Report does not accurately portray the as-found site conditions (whether with deeper or shallower encountered bedrock or with mass unsuitable soils) and claim for additional payment based on change to the scope of work, they shall be required to present to the Architect a comparison of the quantities portrayed by the geotechnical report with that actually performed in the field, as calculated by an independent Professional (Civil) Engineer. Analysis shall be performed using 3-dimensional modeling of the excavation footprint (at both subgrade and at bearing elevation) and variable depths to portray the non-prismatic excavation volume. Actual installed quantities shall be discerned using LiDAR scanning or depth mapping at each spread footing and at 25 foot increments along continuous strip footings by a licensed Surveyor.

D. UNIT PRICES

1. Work of this Section may be affected by unit prices.
2. Unit prices for additive and deductive adjustments shall be the same.
3. Unit prices include labor, materials, tools, equipment, and incidentals required for soil excavation, rock excavation, trimming, shoring, dewatering, fill, and other items for a complete installation.
4. Unit prices for excavation shall include replacement with approved materials.
5. See Division 1 Section "Unit Prices" for a schedule of unit prices.

a. Standard Excavation with cementitious backfill.
b. Standard Excavation with soil backfill.
c. Special Excavation with cementitious backfill.
d. Special Excavation with soil backfill.
e. 2" diameter by 5-feet deep test core.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material (flowable fill) used to fill an excavation.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Drainage Course: Free-draining aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

D. Excavation: Removal of material encountered above bearing elevations and to lines and dimensions indicated.

1. Bulk (Mass) Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
2. Over-excavation: Excavation below bearing elevations or beyond indicated lines and dimensions as directed by Special Inspector and confirmed by Architect.
3. Unauthorized Excavation: Excavation below bearing elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
4. Standard Excavation: Excavation of soil, all floating boulders less than ¾ cubic yard in volume, weathered rock, obstructions, etc. which can accomplished with conventional excavator comparable to model John Deere 210.
5. Special Excavation: Excavation of boulders that exceed 3/4 cubic yard in volume or bedrock which requires systematic drilling, ram hammering, ripping, or blasting (when permitted). Excavation of Footings which require in excess of late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179. Special Excavation includes both removal and disposal of rock.

E. Fill: Soil materials used to raise existing grades.

F. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that cannot be removed by Standard Excavation.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, or other man-made stationary features constructed above or below the ground surface as shown on the structural drawings.

H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.

2. Laboratory compaction curve according to ASTM D 698.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, GC, SW, SP, SM, SC, CH, and CL according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. No concentration of large fragments is permitted unless approved by Geotechnical Engineer and Architect.

1. Plasticity Index: Less than 30.
2. Liquid Limit: Less than 50.
3. Swell potential: Less than 50 psf.
4. Maximum dry density of at least 100 pounds per cubic foot.

C. Unsatisfactory Soils: Soil Classification Groups ML, OL, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
2. Shot rock, asphalt, and coal fragments.
3. Organics content shall be less than 5%. Limit total depth of soil fills with organic contents over 4% to 24”.
4. Soils containing 40% and greater silt content will not be accepted for use in any capacity and shall be wasted off site.

D. Subbase Materal, Drainage Course and Drainage/Wall Backfill (Crushed Stone): Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; meeting Kentucky Transportation Cabinet Standard Specification for #57 stone; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material Performance Additive:

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Darafill or Darafill Dry, W.R. Grace & Co.
b. Rheomac VMA 362, BASF Corporation – Admixture Systems

B. Prohibited Admixture: Calcium chloride thiocyanates or admixture containing more than 0.05 percent chloride ions.

C. Controlled Low Strength Material CLSM (Flowable fill): Self-compacting, flowable concrete material. Provide blend of cement, flyash, and sand with minimum cementitious content as follows:

1. Excavatable flowable fill: 100 lb cement and 250 lb fly ash per cubic yard.
2. Structural flowable fill (250 psi): 175 lb cement and 200 lb fly ash per cubic yard. Add CLSM performance additive at manufacturer's recommended dosage rate, adjusting water content to provide desired flow and strength characteristics.

2.3 GEOTEXTILES

A. Non-Woven Geotextile – Nonwoven, needle-punched geotextile made of 100% polypropylene staple filaments. Resistant to ultraviolet and biological deterioration, rotting, and naturally encountered basics and acids. Stable within a pH range of 2 to 13. Weight of 4 oz/yd. Minimum Tensile Strength of 100 lbs per ASTM D-4632, Elongation at break of 50% measured per ASTM D-4632, Puncture Strength of 65 lbs measured per ASTM D-4833, CBR puncture of 250 lbs measured per ASTM D-6241, Apparent Opening Size of 70 US Sieve measured per ASTM D-4751, Permittivity of 2.00 Sec^{-1} measured per ASTM D-4491, Water Flow Rate of 140 $g/min/f^2$ measured per ASTM D-4491, and UV Resistance at 500 Hours of 70% measured per ASTM D-5255.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

C. All undercut and engineered backfill remedial work recommended by the Special Inspector and caused by inadequate dewatering and drainage practices during construction shall be provided at no additional cost to Owner.

3.3 EXCAVATION, GENERAL

A. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Remove rock to lines and subgrades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.

b. 12 inches outside of concrete forms at footings.
c. 24 inches below bottom of footings where footings specified to be soil bearing.
d. 6 inches outside of minimum required dimensions of concrete cast against grade.
e. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
f. 6 inches beneath bottom of concrete slabs-on-grade.

C. Excavate pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.4 STRUCTURAL EXCAVATION

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate soils by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Recompact areas loosened by excavation operations prior to reinforcing steel placement.
3. Remove loose soil, debris, and excess surface water from the bearing surface prior to concrete placement.

B. Over-excavate all soft and deleterious material below foundations as directed by Special Inspector and backfill back to foundation bearing elevation with approved fill material.

C. For foundations classified as soil-bearing on the structural drawings, undercut and maintain similar bearing material type and depths.

1. Remove all rock within two-feet below bottom of foundation and replace with approved engineered soil backfill.
2. In mass earth fills 4 feet or deeper, overexcavate both existing and new fills below footing to an elevation where depth of fill is 4 feet or less, and backfill with approved cementitious material to footing bearing.

D. For foundations classified as rock-bearing on the structural drawings, remove all soil, floating boulders, and weathered rock overburden to achieve bearing elevation noted.

3.5 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Special Inspector determines that unsatisfactory soil is present, notify Architect and receive direction. Once received, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. A loader scraper is also permitted. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for [changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 1500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL, GENERAL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Do not backfill below footings with crushed stone where building foundations classified as soil bearing on the structural drawings.

3.9 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact engineered fill material in layers to required elevation.

C. Place fill on subgrades free of mud, frost, snow, or ice.

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight. Maintain the moisture content as such.

3.11 COMPACTION OF SOIL/GRAVEL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill gravel (KYTC #57 stone) in layers not more than 8 inches in loose depth and tamp in place. Use hand-operated tampers (plate compactors) where grade differential, at time of tamping, is more than 12-inches on each side of wall or where backfill area extent or accessibility does not facilitate the use of heavy compaction equipment.

C. Place backfill gravel and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
2. When the fill depth will exceed 10 feet, the excess lower portion shall be compacted to at least 100 percent.

3.12 CEMENTITIOUS FILL

A. Place fill on subgrades free of mud, frost, snow, or ice.

B. Place and consolidate in accordance to the recommendations of the Geotechnical Report.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 SUBBASE UNDER CONCRETE SLABS-ON-GRADE

A. Place subbase on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact subbase under cast-in-place concrete slabs-on-grade as follows:

1. Place subbase 6 inches or less in compacted thickness in a single layer.
2. Place subbase that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact each layer of subbase to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. General: The Owner will employ a testing agency that meets the requirements of ASTM E329 to perform tests and to submit test reports. Failure to detect any defective materials shall not prevent later rejection when such defect is discovered or obligate the Architect or Owner for final acceptance.

1. See Section 014110 – Structural Special Inspections and Contract Drawings for testing and inspection to be performed.
2. Test results will be reported in writing to the Architect, Engineer, and General Contractor within 24 hours after tests.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent backfill or foundation placement only after test results for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 03030

SECTION 03151

WATERSTOPS

PART 1: GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes application of Flexible PVC rubber and TPER waterstops to prevent leakage at construction joints and penetrations of concrete retaining and containment structures.

B. Work includes installation of waterstops.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 033000 “Cast-In-Place Concrete” for forms and concrete placement.

1.3 SUBMITTALS

A. General: Submit according to Conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each material and type of application required include product specifications and manufacturer’s written installation instructions and recommendations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer’s original unopened and undamaged containers labeled with manufacturer’s name and product identification.

B. Store materials in a dry, well-ventilated space and out of sunlight.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Do not apply waterstop materials to surfaces where ice or frost is visible. Do not apply waterstop materials in areas with standing water.

B. Comply with manufacturer’s written instructions regarding weather conditions before and during waterstop installation, condition of the substrate to receive waterstop, and protection of the installed waterstop system.

PART 2: PRODUCTS

2.1 PVC TYPE WATERSTOPS

A. PERFORMANCE

PROPERTY	TEST METHOD	REQUIRED LIMITS
Tear Resistance	ASTM D624	300 lb/in min.
Ultimate Elongation	ASTM D638	350% min.
Tensile Strength	ASTM D638	2000 psi min.
Low Temperature Brittleness	ASTM D746	No Failure @ -35°F
Stiffness in Flexure	ASTM D747	700 psi min.
Specific Gravity	ASTM D792	1.38 max.
Hardness, Shore A	ASTM D2240	77 ± 3
Tensile Strength after accelerated extraction	CRD-C 572	1600 psi min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7 days: Weight Change Hardness Change	CRD-C 572	 Between -0.10% / +0.25% ± 5 points

B. MANUFACTURERS

1. PVC Ribbed With Centerbulb Waterstop Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

   a. 717 3/8” x 6” PVC Waterstop by Sika Greenstreak.
   b. PVC638 3/8” x 6” PVC Waterstop by J P Specialties, Inc.
   c. RCB-6316 3/8” x 6” PVC Waterstop by BoMetals, Inc.

C. ACCESSORIES

1. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.

2. Provide grommets, pre-punched holes, or hog rings (installed by others) spaced at 12 inches on center along length of waterstop.

3. Provide Teflon coated thermostatically controlled waterstop welding irons for field butt splices.

PART 3: EXECUTION

3.1 LOCATION

A. Waterstop is required at all vertical and horizontal construction joints, penetrations, block-outs, and tie-ins in walls and slabs below the maximum fluid level or exterior grade, whichever is higher, in water and waste containment structures.

B. Waterstops shall be placed in other locations as indicated on the Drawings and as required to assure the watertightness of all containers of liquids. Special shop fabricated ells, tees and crosses shall be provided at junctions. Waterstops shall be extended at least 6 inches beyond end of placement in order to provide splice length for subsequent placement. In slabs and tank bottoms, water stops shall be turned up to be made continuous with waterstops at bottom of walls or in walls.

C. Joints between pipe (except cast iron wall pipe) and cast-in-place concrete walls shall be sealed by means of a groove cast completely around the pipe; the groove shall be filled with a quick setting hydraulic compound similar and equal to Waterplug as made by BASF Construction Chemicals mixed and applied in accordance with the manufacturer's instructions.

3.2 INSTALLATION

A. Field butt splices shall be heat fused welded using a Teflon coated thermostatically controlled waterstop welding iron at approximately 380 degrees F. Follow approved waterstop manufacturer recommendations. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.

B. Center waterstop in joint and secure waterstop in correct position using grommets, pre-punched holes, or hog rings (installed by others) spaced at 12 inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel.

3.3 PREPARATION

A. Uncoil waterstop 24 hours prior to installation for ease of handling and fabrication.

B. Position waterstop to ensure proper distance from steel reinforcing bars to prevent rock pockets and honeycomb (see installation section 3.2).

C. Protect waterstop from damage during progress of work.

D. Clean concrete joint after first pour to remove debris and dirt.

3.4 FIELD QUALITY CONTROL

A. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength less than 80 percent of parent section.
2. Misalignment of centerbulb greater than 1/16 inch.
3. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
4. Misalignment that reduces waterstop cross section more than 15 percent.
5. Visible porosity in the weld.
6. Bubbles or inadequate bonding.
7. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.
8. Charred or burnt material.

END OF SECTION

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes. This section applies to concrete work shown on the structural drawings. See Division 32 for site concrete.

B. Cast-in-place concrete includes the following:

1. Lean concrete backfill and mudmats.
2. Foundations and footings.
3. Grade beams.
4. Slabs-on-grade.
5. Foundation walls.
6. Load-bearing building walls.
7. Equipment pads and bases.
8. Grout below column base and bearing plates.
9. Mass concrete.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Structural Special Inspection.”
2. Division 3 Section “Structural Excavation and Backfill” for preparation and excavation of foundations and stone drainage fill.
3. Division 3 Section “Waterstops.”
4. Division 5 Section “Structural Anchors.”
5. Division 7 Section “Thermal and Moisture Protection.”
6. Division 31 Section “Earth Moving” for preparation and excavation of foundations and stone drainage fill.

D. Coordination: Unless other satisfactory agreements are specifically entered into by contractors concerned, all miscellaneous iron and steel, sleeves, anchors, etc., required by work of other contractors, will be furnished and installed by such other contractors with the cooperation of this contractor.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

B. Design Mixtures: For each concrete mixture with laboratory test reports for the following data. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Method used to determine the proposed mix design (per ACI 301, Section 4) unless noted otherwise
2. Mix design requirements for ACI 301, Section 8 for mass concrete.
3. Gradation and quantity of fine and coarse aggregates.
4. Proportions of all ingredients including all admixtures added either at the time of batching or at the job site. Indicate amounts of mixing water to be withheld for later addition at Project site.
5. Water/cement ratio and water/cementitious ratio.
6. Slump – ASTM C143.
7. Certification and test results of the total water-soluble chloride ion content of the design mix – FHWA RD-77 or AASHTO T 260-84.
8. Air content of freshly mixed concrete by the pressure method, ASTM C231, or the volumetric method, ASTM C173.
9. Unit weight of concrete – ASTM C138.
10. Strength at 7- and 28-days for structural concrete– ASTM C39. Document strength on basis of previous field experience or trial mixtures, per ACI 301 Section 4. Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard calculation, and determination of required average compressive strength.
11. Strength at 7- and 28-days for polished concrete surfaces– ASTM C39. Document strength on basis of trial mixture (mandatory), per ACI 301 Section 4. Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard calculation, and determination of required average compressive strength.
12. Complete and include Structural Engineer's standard mix design submittal form for each mix. A blank copy is included at the end of this section.

C. Mass Concrete Submittals:

D.

1. Design mixture information as outlined in Section B, above.
2. Thermal Control Plan with the following items:

    a. Concrete mixture proportions
    b. Calculated or measured adiabatic temperature rise of concrete
    c. Upper limit for concrete temperature at time of placement
    d. Description of specific measure and equipment that will be used to ensure maximum temperature in placement will not exceed maximum temperature limit
    e. Calculated maximum temperature in placement based on expected conditions at time of placement and use of proposed measures to control temperatures.
    f. Description of specific measures and equipment that will be used to ensure temperature difference will not exceed specified temperature difference limit
    g. Calculated maximum temperature difference in placement based on expected conditions at time of placement and use of proposed measures to control temperature differences
    h. Description of equipment and procedures that will be used to monitor and log temperatures and temperature differences
    i. Drawing of locations for temperature sensors in placement
    j. Description of format and frequency of providing temperature data
    k. Description of measures to address and reduce excessive temperatures and temperature differences, if they occur

l. Description of curing procedures, including materials and methods, and curing duration
m. Description of formwork removal procedures to ensure temperature difference at temporarily exposed surface will not exceed temperature difference limit, and how curing will be maintained

E. Steel Reinforcement Shop Drawings: Fabrication and placing drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI SP-066(04) “ACI Detailing Manual” showing 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. Include special reinforcing required for openings through concrete structures.

1. Computer generated electronic structural construction document files (ACAD) will be made available to the Contractor. The Contractor will be required to sign the Engineer’s standard release of liability form prior to receiving the drawing files. Rules for use of said files shall be as defined in the CRSI “Code of Standard Practice” Sections 4.19 and 6.4.1.
2. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.

F. Product Data: For proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, vapor retarder/barrier, construction joint slip dowels, joint systems, mechanical reinforcing splice couplers, fiber reinforcing, curing compounds, dry-shake finish materials, and others if requested by Architect.

G. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:
1. Reglets.
2. Waterstops.
3. Vapor retarder/barrier.

H. Drawings showing proposed construction and/or contraction joint locations.

1.5 INFORMATIONAL SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

B. Welding certificates.

C. Laboratory test reports for concrete materials or material certificates in lieu of material laboratory test reports. Material certificates shall be signed by Manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

D. Survey of the as-built locations of anchor rods, foundation bolts, and other embedded items shall be submitted to the Architect, Engineer, and General Contractor/Construction Manager. Installation tolerances for embedded items used for steel connections shall meet the tolerance requirements of the AISC Code of Standard Practice unless tighter tolerances are specified elsewhere.

E. Written notification that the concrete in the footings, piers, walls, or other bearing support has attained, on the basis of an appropriate ASTM standard test method of field-cured samples, a minimum of 75% of the intended minimum compressive design strength.

F. Written procedures for temperature control and measurement of Mass Concrete as described in ACI 207.1R Sections, 2.8, 4.7 & 4.8.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Each contractor having reference to ACI Documents shall maintain copies of same on project site.

AMERICAN CONCRETE INSTITUTE

1. ACI 117-10 – Specifications for Tolerances for Concrete Construction and Materials.

2. ACI 207.1R-05 – Guide to Mass Concrete.
3. ACI 211.1-91 – Standard Practice for Selecting Proportions Normal, Heavyweight and Mass Concrete (Reapproved 2009).
4. ACI 301-10 – Specification for Structural Concrete.
5. ACI 302.1R-04 – Guide for Concrete Floor and Slab Construction.
6. ACI 304.2R-96 – Placing Concrete by Pumping Methods (Reapproved 2008).
7. ACI 305R-10 – Guide to Hot Weather Concreting.
8. ACI 306R-10 – Guide to Cold Weather Concreting.
9. ACI 308R-01 – Guide to Curing Concrete (Reapproved 2008).
10. ACI 309R-05 – Guide for Consolidation of Concrete.
11. ACI 311.1R-07 – ACI Manual of Concrete Inspection.
12. ACI 318-14 – Building Code Requirements for Structural Concrete and Commentary.
13. ACI 347-04 – Guide to Formwork for Concrete.
14. SP-66 – ACI Detailing Manual.

CONCRETE REINFORCING STEEL INSTITUTE (CRSI):

1. CRSI – Manual of Standard Practice.
2. CRSI RB4.1 – Supports for Reinforcement Used in Concrete (2014a)
3. CRSI – Placing Reinforcing Bars (2011)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC):

1. AISC – Code of Standard Practice. (For anchor rod and embed tolerance limits.)

B. Qualifications of Workers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper execution of the work required by this Division.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

D. Mass Concrete Mockup and Laboratory Submittal: Contractor shall prepare a cast concrete block for the purposes of determining the heat of hydration.

1. Cast concrete 4-foot by 4-foot by 4-foot block using a mass concrete trial mix design if requested by the engineer.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section “Project Meetings” and the following:

1. At least 35 days prior to start of the concrete construction schedule, the contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction.
2. The contractor shall require responsible representatives of every party who are concerned with the concrete work to attend the conference, including but not limited to, the following:

a. Contractor’s superintendent – Laboratory responsible for the concrete design mix – Laboratory responsible for field quality control – Concrete subcontractor – Ready-mix concrete producer – Admixture manufacturer(s) – Concrete pumping contractor – Special Inspector – Specialty Concrete Design Engineer for Mass Concrete.

3. The Architect and the Owner’s Representative may be present at the conference. The Contractor/Construction Manager shall notify the Architect at least five days prior to the scheduled date of the conference.
4. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by them to all parties concerned within five days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner’s representative – Resident engineer – Consultant engineer.

F. Contractor shall be responsible for conducting a survey of the as-built locations of anchor rods, foundation bolts, and other embedded items. Survey to include embed placement, bolt projection, and top of foundation elevation. Survey to be conducted by a Professional Land Surveyor.

G. This project includes Mass Concrete or volumes of concrete with dimensions large enough that require measures to be taken to cope with the generation of heat from hydration of cement and attendant volume changes to minimize cracking. The contractor shall have experience in placing mass concrete. The contractor shall submit mix designs for mass concrete, submit procedure for control of temperature and measurement of temperature, submit curing procedure for mass concrete. Contractor shall have (2) sources of concrete readily available during mass concrete pour in the even one batch plant fails to meet production requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver steel reinforcement and concrete to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel reinforcement off ground by using pallets, platforms, dunnage, or other supports and spacers.

C. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

D. Store waterstops and packaged materials in sealed containers with manufacturer's labels intact. Place under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed (Smooth) Finish Concrete: Exterior-grade high-density overlay (Class 1 or better), medium-density overlay (Class 1 or better with mill-release agent treated and edge sealed), or Structural1 or Class 1 (B-B or better, mill oiled and edge sealed) plywood panels complying with DOC PS1; or new metal-framed and metal faced panels; or other acceptable panel-type materials to provide continuous, straight, and smooth exposed surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Forms for Unexposed, Rough-Formed Finish Concrete: Plywood, lumber, metal or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Non-staining dressed wood, metal, PVC, or rubber strips; ¾ by ¾ inch, minimum, and as shown on Drawings; in longest practical lengths.

D. Form-Release Agent: Commercially formulated form-release agent with maximum volatile organic compounds (VOCs) not to exceed those allowable by jurisdictional regulations 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 (Standard): Factory-fabricated, adjustable-length, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of plastic concrete on forms, prevent form deflection, and to prevent spalling of concrete upon removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, 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.

F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA800, “Specification 810.1, Expanded Cellular Glazing Tape”; minimum ¼ inch thick.

G. Form Joint Sealant: Elastomeric sealant complying with ASTM C920, Type M or S, Grade NS, that adheres to form joint substrates.

H. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, Grade 60, deformed.

C. Welded Wire Fabric: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

E. Smooth Joint Dowel Bars: ASTM A36, plain-steel bars, cut true to length with ends square and free of burrs.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars 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.

G. Fabric Supports: Chairs for spacing, supporting welded wire fabric in place. Use continuous wire chairs complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer, unless noted otherwise.

B. Cementitious Materials:
1. Portland Cement: ASTM C 150, Type I or Type III (high early strength when specified). Fly Ash: ASTM C 618, Class F or C, except maximum loss on ignition: 3%. Ground Granulated Blast-Furnace Slag (GGBFS): ASTM C 989, Grade 100 or 120. Silica Fume: ASTM C 1240, amorphous silica.
2. Portland Cement (Mass Concrete when specified): ASTM C 150, Type II, containing less than 8% C_3A and less than 58% C_3A and C_3S combined. Fly Ash: ASTM C 618, Class F, except maximum loss on ignition: 3%. Slag Cement: ASTM C 989, Grade 80.
3. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag, Type IP, portland-pozzolan, Type IL, portland-limestone, or Type IT, ternary blended cement.
4. Blended Hydraulic Cement: ASTM C1157 (Performance Specification for Hydraulic Cements) – Type GU (General Use), Type HE (High-Early Strength).
5. One brand of cement shall be used throughout Project duration unless otherwise acceptable to Engineer.

C. Normal-Weight Aggregates: ASTM C 33 Class 3S coarse aggregate or better, graded, and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances considered deleterious or that cause spalling or surface discoloration due to oxidation.
2. Fine Aggregate to be free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 1602 and potable.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
7. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
8. Air-Entraining Admixture: ASTM C 260.

F. Controlled Low Strength Material (CLSM) Performance Additive

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Darafill or Darafill Dry, GCP Applied Technologies, Inc.
b. MasterMatrix VMA 362, BASF Corporation.

2.4 RUSS-FLO, RussTech Admixtures, Inc.RELATED MATERIALS

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.022-inch thick (26-gage) galvanized sheet steel. Temporarily fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Non-High Strength Rods (Straight, Headed & Partially Threaded) for heavy structural steel, PEMB: ASTM F1554 Grade 36 and heavy hex carbon-steel nuts.
2. Plate Washers: ASTM A36.

C. Construction joint slip dowels: steel rod or plate in a plastic insert to allow contraction of the concrete while preventing vertical differential displacement.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. #6x2’-0” long, Speed Dowel by Sika Greenstreak.
b. 3/8” plate, Diamond Dowel by PNA, Inc.
c. 3/8” plate, Speed Plate by Sika Greenstreak.

D. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or non-impregnated, flexible, synthetic foam with standard bonding agent to hold in place.

E. Sheet Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyolefin/Resin or multi-ply extrusion coated polyethylene sheet not less than 10 mils thick conforming to ASTM E 1745 Class A. Maximum water vapor permeance when tested in accordance with Test Method ASTM E154, Sections 8, 11, 12, and 13 (based on ASTM E96) or ASTM F1249 of 0.038 perms. Minimum tensile strength when tested to ASTM D882 of 45 lbs-force/inch.
2. Accessories: All must be from the same manufacturer of the vapor barrier material used, or must be approved by the vapor barrier manufacturer in writing and submitted to the Architect for record.

a. Seams: Manufacturer approved seam tape.
b. Sealing Permanent penetrations of vapor retarder: Manufacturer approved vaporproofing mastic or tape.

c. Perimeter edge/seal: Manufacturer approved tape with a textured surface that creates a mechanical seal to freshly-placed concrete, termination bar, or double-sided sealant tape.
d. Non-permanent penetration prevention: Manufacturer approved peel and stick stake base/foot and film safe screed system.

3. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Perminator Vapor-Mat with Perminator Tape Seal. W.R. Meadows, Inc.
b. Stego Wrap with Stego Tape Seal. Stego Industries, LLC.
c. Viper Vaporcheck II with manufacturer's recommended tape seal. Insulation Solutions, Inc.
d. Vaporblock VB10 with Vapor Bond Plus Tape Seal. Raven Industries, Engineered Films Division.
e. Xtreme with Xtreme Tape Seal. Tex-Trude, LP.

F. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.

G. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

H. Cartridge Injection Adhesive (for reinforcing dowels): two-component material for use in concrete. Anchor to be approved for use with cracked concrete per AC308.

1. Acrylic resin adhesive, suitable for use on dry or damp surfaces. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. HIT HY 200 V3 System, Hilti.
b. AC 200+, DeWalt/ Powers.
c. AT-XP System, Simpson/Strong-Tie.

2. Epoxy adhesive, suitable for use on oversized, cored, and wet holes and in submerged applications. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. A7+ System, ITW Red Head.
b. HIT RE500 V3 System, Hilti.
c. PURE 110+, DeWalt/Powers.
d. SET-XP Epoxy System, Simpson/Strong-Tie.

I. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time. Grout to have a minimum compressive strength at 28 days of 8,000 psi when applied in a flowable consistency.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. SureGrip High Performance Grout, Dayton Superior.
b. NS Grout, The Euclid Company.
c. Masterflow 928, BASF Construction Chemicals.
d. Sikagrout 328, SIKA.

2.5 FLOOR AND SLAB TREATMENTS

2.6 LIQUID FLOOR TREATMENTS

A. Penetrating Concrete Sealer: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

a. BASF Corporation; Construction Systems.
b. ChemMasters, Inc.
c. Dayton Superior.
d. Euclid Chemical Company.
e. Kaufman Products, Inc.
f. L&M Construction Chemicals, Inc.
g. Metalcrete Industries.
h. PROSOCO, Inc.
i. SpecChem, LLC.
j. W. R. Meadows, Inc.

2.7 CURING MATERIALS

A. Absorptive Cover for non-exposed concrete: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Wet-curing Blanket for exposed architectural concrete: ASTM C171-03 and AASHTO M171-00 natural cellulose fabric for single use application. Rolls to be new, shrink-wrapped in poly covering until used.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. UltraCure NCF, Sika.
b. Single-Use Curing Blanket, Masco.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. General: All non-dissipating compounds shall be certified by curing compound manufacturer to not interfere with bonding of floor covering. Where liquid floor treatment or colored stain system is used, provide material recommended by the manufacturer of the treatment for use in a compatible, integrated system. See “Polished Concrete” specification for products and requirements for use on polished concrete floor systems.

F. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete for temporary protection from rapid moisture loss.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

H. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating.

I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.8 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field data methods, or both, according to ACI 301. Mix proportions shall be established so that the concrete can be placed readily without segregation into forms and around reinforcement under anticipated placement conditions. Use an independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures. Trial batch and field experience tests shall have been performed within 24 months of submittal date. Use mix design submittal form included at the end of this section.

1. Do not use the same testing agency for field quality control testing.

B. Submit written reports to Architect of each proposed concrete mix type at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect. The approved mix designs shall be used throughout this project unless changes are approved by the Architect/Engineer prior to use.

C. Cementitious Materials: Supplier shall coordinate surface treatment compatibility with cementitious materials. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 20 percent for Type F or 25 percent for Type C except for lean or flowable backfill. Use of fly ash in concrete for use in colored concrete, polished concrete floor systems, or where incompatible with admixtures or other treatments is prohibited.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Slag Cement: 50 percent.
4. Combined Fly Ash or Pozzolan and Slag Cement: 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, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete as required for placement and workability and in all pumped concrete and concrete required to be watertight.
2. Use accelerating and retarding admixtures at Contractor’s discretion to control set time when required by extreme temperatures or humidity, or other adverse placement conditions. Use accelerating admixture in concrete slabs placed at ambient temperatures below 35 deg F.

E. Concrete Mix Density:

1. Normal-weight plain concrete shall have a unit density of 146 pounds per cubic foot plus or minus 6 pounds per cubic foot.
2. Light-weight plain concrete shall have a unit density as listed in the following concrete mix designs.

F. The minimum compressive strength measured 28 days after placement (f'_c), minimum cementitious content, slump, maximum water/cementitious content ratio (W/C), and air

content of the concrete for each portion of the structure shall be as follows, unless noted otherwise:

1. Mix Type **1**. Controlled Low Strength Material CLSM (Flowable fill). Provide blend of cement, flyash, and sand with minimum cementitious content as follows:

    a. Excavatable flowable fill: 100 lb cement and 250 lb fly ash per cubic yard.
    b. Structural flowable fill (250 psi): 175 lb cement and 200 lb fly ash per cubic yard. Add CLSM performance additive at manufacturer's recommended dosage rate, adjusting water content to provide desired flow and strength characteristics.

2. Mix Type **2**. Lean Concrete Backfill and Mudmats. Normal-weight concrete.

    a. Minimum Design Compressive Strength: 1,500 psi.
    b. Minimum Cementitious Material: 200 lbs/cy.
    c. Slump Limit: N/A.
    d. Air Content: Natural.

3. Mix Type **3**. Grade Beams and Micropile Caps. Normal-weight concrete.

    a. Minimum Design Compressive Strength: 4,000 psi.
    b. Minimum Cementitious Material: 550 lbs/cy.
    c. Slump Limit: Minimum of 6 inches and maximum of 8 inches, plus or minus 1 inch.
    d. Air Content: Natural.

4. Mix Type **4**. Interior Framed Walls, and Piers. Normal-weight concrete.

    a. Minimum Design Compressive Strength: 4,000 psi.
    b. Minimum Cementitious Material: 505 lbs/cy.
    c. Water Reducing Admixture: Mandatory.
    d. Slump Limit: Maximum 4 inches or 8 inches after adding admixture to 2-to-3-inch slump concrete, plus or minus 1 inch.
    e. Air Content: Natural.

5. Mix Type **5**. Interior Slab on Grade and Equipment Bases. Normal-weight concrete.

    a. Minimum Design Compressive Strength: 4,000 psi.
    b. Minimum Cementitious Material: 505 lbs/cy.
    c. Water Reducing Admixture: Mandatory.
    d. Slump Limit: Maximum 8 inches after adding water reducing admixture to 2-to-3-inch slump concrete, plus or minus 1 inch.
    e. Air Content: Maximum 3 percent.

6. Mix Type **6**. Exterior Walls, , Piers, Horizontal Concrete under roof but in open structures, and Equipment Bases. Normal-weight concrete.

    a. Minimum Design Compressive Strength: 4,500 psi.
    b. Minimum Cementitious Material: 550 lbs/cy. With an approved water-reducing agent, minimum cement content may be reduced by 47 pounds of cement per cubic yard.
    c. Maximum W/C Ratio: 0.45.
    d. Water Reducing Admixture: Optional.
    e. Slump Limit: Maximum 4 inches or 8 inches after adding admixture to 2-to-3-inch slump concrete, plus or minus 1 inch.
    f. Air Content: 5.5 percent for 1 ½-inch maximum aggregate.

6.0 percent for 1-inch maximum aggregate.
6.0 percent for ¾-inch maximum aggregate.
7.0 percent for ½-inch maximum aggregate.

7. Mix Type**7**. Exterior structural horizontal concrete exposed to weather or deicer chemicals. Normal-weight concrete.

   a. Minimum Compressive Strength: 5,000 psi.
   b. Minimum Cementitious Material: 564 lbs/cy.
   c. Maximum W/C Ratio: 0.40.
   d. Water Reducing Admixture: Optional.
   e. Slump Limit: 4 inches or not more than 8 inches after adding admixture to 2-to-3-inch slump concrete, plus or minus 1 inch.
   f. Air Content: 5.5 percent for 1 ½-inch maximum aggregate.
      6.0 percent for 1-inch maximum aggregate.
      6.0 percent for ¾-inch maximum aggregate.
      7.0 percent for ½-inch maximum aggregate

8. Mix Type 8. Mass Concrete. Normal-weight concrete.

   a. Minimum Design Compressive Strength: 4,000 psi (56 days).
   b. Maximum Cementitious Material: 500 lbs/cy.
      1) Replacement of cement content shall not be less than 30 percent nor exceed 50 percent.
   c. Maximum W/C Ratio: 0.45.
   d. Water Reducing Admixture: Required.
   e. Set Controlling Admixture: Optional.
   f. Slump Limit: Maximum 6 inches after adding water reducing admixture to 1-to-2-inch slump concrete, plus or minus 1 inch.
   g. Air Content: Maximum 5 percent.

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

   1. 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: Is not permitted. 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

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMWORK INSTALLATION

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 concrete structure can support such loads.

1. For Mass Concrete applications contractor shall design formwork for at least 125% of wet concrete hydrostatic pressure to account for impact.

B. Construct formwork so concrete members and structures are of correct size, shape, lines, alignment, elevation, position, level, plumb, and dimension and indicated. Maintain formwork construction tolerances and surface irregularities within limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8-inch tolerances for smooth-formed concrete surfaces exposed to view.
2. Class D tolerances for earth formed foundation elements. Tolerance applies as a variation inward towards reinforcing only. No tolerance limit away from reinforcing applies.
3. Class C, ½-inch tolerances for other concrete surfaces.

D. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspections where interior area of formwork is inaccessible before and during concrete placement. 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.

H. Form openings, chases, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, and other features required in the Work. Chamfer exposed corners and edges at exterior corners and edges of permanently exposed concrete and as indicated, to produce uniform smooth, straight lines and tight edge joints.

I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

J. Earthen forms may be used for footings and foundation elements when ground is stable and capable of resisting erosion and fluid pressure of wet concrete without sloughing. All tolerances and clear covers shall be maintained. Excavation shall be clean of all loose soil and mud along bottom and sides.

K. Use selected materials to obtain required finishes.

L. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. 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.

1. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed.
2. Do not spray reinforcing with form oil.
3. Coat steel forms with a nonstaining, rust-preventative material. Do not use rust-stained steel form-facing material.

3.3 INSTALLING EMBEDDED ITEMS

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

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303. Column anchor rods shall be set in a rigid template and securely braced to formwork or ground prior to placing concrete. Anchor rods shall not be “wet set” in plastic concrete.
2. Install dovetail anchor slots in concrete structures as indicated.
3. Install reglets to receive sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
4. Aluminum conduit shall not be installed in concrete.

3.4 REMOVING AND REUSING FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must first be sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations shall be maintained.

1. Remove forms only if shores and other vertical supports have been arranged to permit removal without loosening or disturbing shores.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained at least 75 percent of its 28-day design compressive strength unless noted otherwise. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

1. Cantilevered construction shall be shored for a minimum of 28 days after being placed.
2. Mass Concrete construction formwork shall not be removed until concrete has attained 75 percent of its 56-day design compressive strength.

C. 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 as specified for new formwork.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets.

1. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.5 SHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring.

1. Do not remove shoring until measurement of slab tolerances is complete.

B. Remove shores in a planned sequence to avoid damage to partially cured concrete.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with Concrete Reinforcing Steel Institute’s (CRSI) "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Deliver reinforcement to job site bundled, tagged and marked. Use waterproof tags indicating bar size, length, and mark corresponding to placing drawings.

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

D. When permitted, field bend bars cold, except during cold weather when moderate heating is necessary to avoid brittle failures.

E. Install reinforcing to mechanical splices in accordance with the manufacturer’s requirements.

F. Accurately position, support, and secure all bar reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum coverages as indicated for concrete protection.

1. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
2. Walls with reinforcing mats on each face shall have bent U-bar spacers tied to each mat to hold spacing between mats. U-bar spacers shall be minimum #3 bars spaced a maximum of 6 feet on center horizontally and vertically with a row of bars placed at the top of any wall over 4 feet tall.
3. All walls shall have chairs or bolsters placed between reinforcing mat(s) and both form faces spaced a maximum of 6 feet on center to maintain clear cover.

G. Install welded- wire fabric reinforcement in longest practicable lengths on fabric supports spaced to minimize sagging. Lap edges and ends of adjoining pieces at least one full mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace outermost cross wires of lace splices with wire to prevent lifting of the ends during concrete placement.

1. Chair welded wire fabric slab reinforcement with continuous chairs spaced a maximum of 32 inches on center. Provide additional chairs as required. Lift welded wire fabric back into position between chairs where depressed during concrete placement. Lifting welded wire fabric into position during concrete placement without the use of chairs is not permitted.

H. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

I. Weld reinforcing bars and fabric, only where indicated, according to AWS D1.4. Do not tack weld crossing reinforcing bars.

J. Construction tolerances shall be in accordance with ACI 117 and the following:

1. For member depths 12” and smaller, tolerance on concrete cover shall be the smaller of -3/8” and -(1/3)*[specified cover].
2. For member depths larger than 12”, tolerance on concrete cover shall be the smaller of -1/2” and -(1/3)*[specified cover].
3. At formed soffits, tolerance on concrete cover shall be -1/4”.
4. Tolerance for longitudinal location of bends and ends of reinforcement:
   a. At discontinuous ends of brackets and corbels, ±1/2”.
   b. At discontinuous ends of other members, ±1”.
   c. At other locations, ±2”.

3.7 PLACING ADHESIVE SYSTEM

A. General: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Holes may be dry, damp or wet. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

1. Drill holes with rotary impact hammer drills using carbide-tipped bits and core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
2. Cored Holes: Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Acrylic Adhesive Anchors shall not be installed in core drilled holes.
3. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling.
4. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.
5. Perform anchor installation in accordance with manufacturer instructions.

3.8 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints in Reinforced Structure and Foundations: Locate and install construction joints so they do not impair strength or appearance of the structure, at locations indicated or otherwise as acceptable to Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form continuous keyways as indicated. Embed keys at least 1-1/2 inches into concrete. Provide keyways 1/3 the member thickness, or 3 ½" minimum, in walls, footings, and between walls and footings centered in the member thickness unless shown otherwise. Provide keyways ½ member width by ½ member depth in grade beams, beams, and columns and between grade beams / beams and supporting members centered in the member unless shown otherwise.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Construction Joints in Slab on Grade: Provide slip dowels (as shown on drawings) for construction joints in field of slabs on grade less than 6" thickness. Provide continuous keyways at least 1 1/2 inches deep by 1 ½" wide or slip dowels (as shown on drawings) in construction joints in slabs on grade 6" or thicker. Provide continuous keyways at least 1 1/2 inches deep by one third the slab thickness centered in the construction joint of all formed concrete slabs.

1. Bulkheads designed and accepted for this purpose shall be used for doweled joints. Use manufactured plastic sleeves as indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint for non-sleeved dowels.
2. Prefabricated pourstop with keyway may be used for simultaneous placement of adjacent slab panel at Contractor's option, where approved by Architect. Use leave-in-place joint system that is compatible with floor finish or treatment system.
3. Where construction joints at doorways that align with both faces of bearing wall are specified, utilize preformed pourstop with keyway in lieu of slip dowels.
4. Where joints will be exposed to view in public spaces or warehousing areas, joints shall be straight, crisp, and with sharp edges. Slabs shall be flush across joint.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips flush with top of slab to prevent contact or bonding between the slab and the adjoining member. Use strips with perforated strips that remove the top portion to be not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
4. At locations where drawings do not specifically call for premolded filler, provide bond breaker between slab and vertical surface. The vapor retarder may be turned up and used for this purpose.

5. Provide ½" expansion joint between slab and all door jambs (at end of walls in opening).
6. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

E. Contraction (Control) Joints in Slabs-on-Grade: Construct weakened-plane contraction joints, sectioning concrete into areas as indicated, and to a depth equal to at least one-fourth depth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groove-tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
3. Contraction joints may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
4. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
5. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

F. Provide waterstops in construction joints in all retaining walls (and their integral piers and columns) below grade and as indicated. Refer to Waterstop Specification.

3.9 VAPOR RETARDER / BARRIER INSTALLATION

A. Sheet vapor retarders and barriers: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions. Place sheeting in position with longest dimension parallel with direction of pour.

1. Extend film fully over slab area to the full perimeter of the slab. Turn film up 2" onto surrounding wall/column/piers/etc. and seal to vertical element with continuous mastic or tack tape capable of adhering to concrete and masonry. Film and tape shall not extend above finished floor.

a. At the point of termination, seal vapor retarder to the foundation wall, footing, grade beam or slab itself. Where obstructed by impediments (such as dowels, waterstops, or any other site condition requiring early termination of the vapor retarder), use manufacturer's recommended accessories for such non-standard terminations.

2. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.
3. Apply seam tape to a clean and dry film only.

B. Seal around all penetrations (including all conduit and pipes) through film with manufacturer's recommended mastic or pressure-sensitive tape. Cut slit around penetrations to place initial layer of film.

1. For small penetrations, tape film directly to the penetrating element.
2. For penetrations larger than 2", create collar for penetration of 12" wide by 1 ½ times the penetration's circumference with fingers cut half the width of the film. Wrap the collar around the penetration, tape the collar onto the strip of film, and tape the fingers at each edge/slit to the initial layer of film.

C. Avoid the use of non-permanent stakes driven through film. If non-permanent stakes are driven through film, repair and seal as recommended by film manufacturer.

D. Repair damaged areas of film material of similar (or better) permeance, puncture resistance, and tensile strength.

3.10 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, “Guide for Measuring, Mixing, Transporting, and Placing Concrete,” and as specified. Concrete delivery tickets shall show:

1. Batch number.
2. Mix by number with cement content in pounds and maximum size aggregate.
3. Admixtures.
4. Air content.
5. Slump.
6. Time dispatched and discharged.
7. Date.
8. Contractor.
9. Ready Mix Supplier.
10. Project Name and Address.
11. Volume of Concrete.

C. Do not add water to the concrete mix during delivery, at Project site, or during placement unless approved by the General Contractor’s) representative, noted on the delivery ticket with the amount of water, and signed by the General Contractor’s representative. The maximum water/cement ratio of an approved mix design shall not be exceeded.

1. When the ambient air temperature is between 80 and 90 degrees Fahrenheit, one (1) gallon of water per cubic yard of concrete may be added at the job site to compensate for water evaporation during transit.
2. When the ambient air temperature exceeds 90 degrees Fahrenheit, two (2) gallons of water per cubic yard of concrete may be added at the job site to compensate for water evaporation during transit.
3. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Discharge concrete within 1 ½ hours after water has been added to the cement, unless a longer time has been authorized by the Architect/Engineer. During hot weather or other conditions contributing to a quick stiffening of the concrete, the Architect/Engineer may require discharge in less than 1 ½ hours.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is 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. Do not allow concrete to drop more than 5 feet or from a height which allows concrete to fall against reinforcing.

1. Deposit concrete in forms in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid

cold joints. Do not subject concrete to any procedure that will cause segregation. Deposit concrete as near as possible to the final position to avoid segregation.

2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

F. 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.

1. For concrete supported on metal deck or other form, place concrete in manner to avoid overloading the deck/form. Avoid concentrated concrete ponding areas and avoid concentrated dumping of concrete.
2. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in proper position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Slope surfaces uniformly to drains where required.
6. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: When air temperature is expected to fall below 40 degrees Fahrenheit (4 deg C) within the first 72 hours after concrete placement, comply with provisions of ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When mean daily air temperature is expected to fall below 40 deg F (4 deg C) for more than three successive days after concrete placement, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature at point of placement as follows:

   a. Not less than 55 deg F (13 deg C) or more than 75 deg F (24 deg C) for concrete sections less than 12 inches in the least dimension (width or thickness).
   b. Not less than 50 deg F (10 deg C) or more than 70 deg F (21 deg C) for concrete sections 12 inches or greater in the least dimension (width or thickness).

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305.1 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

I. Pumping Concrete: Grout used to prime a pump shall not be placed in the forms of any concrete exposed to view in the final structure. Concrete shall not be pumped through pipe made of aluminum or aluminum alloys.

1. Mass Concrete Placement: Contractor shall take precautions to ensure that surface to core temperature differentials don't exceed 35°F and that concrete temperatures do not exceed 160°F. Proper construction management, where efforts are made to protect the structure from excessive temperature differentials by knowledge of concrete handling, construction scheduling, and construction procedures shall be utilized. See Hot-Weather Placement section above for tips for reducing concrete temperature rise if required. Temperature Control and Monitoring: Contractor shall install (1) thermocouple in the core of each wall and (1) thermocouple 2" below the surface of each wall. Place back-up thermocouple at each location. Provide data to engineer and special inspector daily.

3.11 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is an as-cast concrete surface having texture imparted by form-facing material used. Repair and patch tie holes, honeycombing over ½ inch in depth, and other defective areas. Remove fins and other projections exceeding ¼ inch in height by rubbing down, chipping, or grinding off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view in non-public rooms (storage, mechanical rooms, etc.) or to be covered with a coating or covering material applied directly to concrete. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes, honeycombing over ¼" in depth, and other defective areas. Remove fins and other projections exceeding 1/8" in height by rubbing down or grinding off until completely removed and smoothed.

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

3.12 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation

of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units.

2. Allow moisture film or sheen to disappear from the floated surface and allow the concrete to harden enough to prevent fine material and water from being worked into the concrete surface. Then begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks and uniform in texture and appearance.
3. For concrete surfaces to be covered with hardwood flooring, immediately prior to installation of wood flooring the Wood Flooring Contractor shall profile the floor on a 5-foot grid pattern. At that time, the General Contractor shall be responsible for all labor and materials necessary to achieve a tolerance level of 1/8" in 10'-0", subject to approval of the Wood Flooring Contractor.
4. Finish surface to specified tolerances for floor flatness and floor levelness measured according to ASTM E 1155. Minimum local values shall be 2/3 of the specified composite F-number. Unless otherwise shown or noted on the drawings, comply with the following table:

Slabs on Grade and Formed Elevated Concrete Slabs (Shored Construction)

Composite Flatness F(F)	Composite Levelness F(L)	Typical Use
20	15	Mechanical rooms and non-public areas
35	25	warehouse floors with moderate to heavy traffic

C. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

D. Slip-Resistive Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, and sloped walks as indicated. Apply according to manufacturer's written instructions and as follows:

1. After completing float finishing and before starting trowel finish, uniformly spread 25 lb of dampened slip-resistive aggregate per 100 sq. ft. of surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply trowel finishing as specified.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

E. Surface Cleaning: Where concrete surface is to be left exposed or sealed with thin film or penetrating coating, burnish or burn to remove all protruding synthetic fiber reinforcing.

F. Exposed Concrete Slabs: Slabs exposed to view in the public spaces shall be free of trowel marks and uniform in texture and appearance. Sharply defined low and high spots are prohibited and cause for rejection by Architect. Grinding and patching to correct discrepancies will be prohibited unless acceptable to Architect. Use new, clean blankets and other protections that will not discolor or dull the finish.

3.13 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Curbs: 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: Provide machine and equipment bases and foundations as shown on drawings. Coordinate sizes and locations of concrete bases with actual equipment to be provided.

1. Construct concrete bases as indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Finish all mechanical housekeeping pads to a finished tolerance of 1/8” in 10 feet.

D. Grouting of Column Base Plates: Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces, protect installed materials, and allow to cure.

1. Comply with manufacturer’s instructions for proprietary grout materials.
2. Grout shall be installed and cured before any elevated concrete slab supported on said columns are placed and prior to installing structural framing in excess of the third story above.

3.14 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Compatibility: Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete. Dosage rate and material compatibility of curing compound shall be coordinated with the Polishing Contractor for polished concrete floor systems.

C. For cold-weather protection during curing, comply with ACI 306.1 and the following:

1. All freshly placed concrete shall be kept from freezing for the following periods:

   a. 3 days for all concrete with an air entraining admixture.
   b. 4 days for all concrete without an air entraining admixture.

2. A cumulative curing time of seven days at a minimum surface temperature of 50 degrees F (10 degrees C) shall be provided or until concrete has attained 75% of its design strength. This shall be followed by cooling of concrete in a gradual transition to surrounding conditions. The temperature drop during this period shall not be at a rate exceeding 2 degrees F per hour until the outside or surrounding temperature is reached.

3. When concrete is placed under conditions of cold weather concreting (defined as a period when the mean daily temperature drops below 40 degrees F for more than three successive days), take additional precautions as specified in “Cold Weather Concreting” by the American Concrete Institute (ACI Report 306) when placing, curing, monitoring and protecting the fresh concrete.

D. For hot-weather protection during curing, comply with ACI 301 and the following:

1. When concrete is placed under conditions of hot weather concreting, provide extra protection of the concrete against excessive placement temperatures and excessive drying throughout the placing and curing operations. Hot weather is defined as air temperature which exceeds 80 degrees F or any combination of high temperature, low humidity and/or high wind velocity that causes a rate of evaporation in excess of 0.2 pounds per square foot per hour as determined by Figure 2.1.5 of ACI Report 305. Hot weather curing is required if these conditions occur within a 24-hour period after completion of concrete placement.
2. Forms, reinforcing and the air shall be cooled by water fog spraying immediately before placing concrete.
3. Immediately following screeding, protect concrete by applying the specified evaporation retarder in accordance with the recommendations of the manufacturer.

E. Evaporation Retarder: 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. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

F. Formed Surfaces: Cure formed concrete surfaces, including walls, columns, sides and underside of beams, supported slabs, and other similar surfaces, by moisture curing with forms in place for 7 days or until forms are removed. If forms are removed within the first 7 days, continue moisture curing without forms for the balance of the 7-day curing period.

1. For vertical surfaces, after the concrete has hardened and while the forms are still in place, the form ties shall be loosened and water shall be applied to run down the inside of the form to keep the concrete wet.
2. After formwork has been removed from vertical surfaces, keep surface continuously wet by water spray or water-saturated absorptive cover.

G. Mass Concrete: Concrete containing Ground Granulated Blast Furnace Slag (GGBFS) shall be wet cured for 14 days.

H. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

1. Cure interior and exterior slab surfaces exposed to deicing salts and slabs where the finish flooring is not compatible with curing compounds by Moisture Curing.
2. Cure slab surfaces to receive hardwood flooring or sports rubber systems by Moisture Curing.

I. Cure concrete according to ACI 308.1 by one or a combination of the following methods:

1. Moisture Curing (standard surfaces): Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. Curing Polished Concrete Surface: Apply UV dissipative curing compound as soon as possible after the concrete receives its final finishing.
   b. Curing Exposed Architectural Slab Surfaces: Apply curing aid as soon as possible after the concrete receives its final finishing using a short nap roller to apply a uniform film. Spray application is prohibited.
   c. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.15 LIQUID FLOOR TREATMENT APPLICATION

A. General: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than seven days old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

C. Penetrating Concrete Sealer

1. Apply penetrating concrete sealer to all concrete floor surfaces exposed to view in the finished structure.
2. Coverage rate shall be 300 square feet (maximum) per gallon.

3.16 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

D. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.17 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval. Repair architectural exposed formed and exposed slab surfaces only with specific prior approval by Architect (cutting, grinding, and patching of these surfaces will generally be prohibited).

B. Contractor shall make mockup of any repairs for review by Architect prior to performing repairs. Coordinate placement and size with Architect prior to proceeding.

C. Patching Mortar: Mix dry-pack patching mortar, consisting of 1-part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water. Use only enough liquid as required for handling and placing.

D. Repairing Formed Surfaces: 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.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. 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.
2. Cut tie rods and bolts flush with the surface and drill out to minimum depth of 1 inch below the surface.
3. Fill through wall tie holes with nonmetallic, shrinkage-resistant grout to within 1 ½” of wall face using a grout bag or other similar means to completely fill the void. Fill any remaining tie hole, including holes from snap-off type form ties, 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 matches 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 Architect.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding smooth (at covered slabs only) any surface defects that would telegraph through applied floor covering system.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks to be covered with covering capable of bridging and concealing crack and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks to be covered with covering capable of bridging and concealing crack and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
8. Repair random cracks in exposed architectural concrete slab on grade by fully removing and replacing slab between existing control or construction joints. Drill and install dowel bars between new and existing slab as directed by Engineer.
9. Repair random cracks in exposed architectural suspended concrete slab by fully removing and replacing slab as directed by Architect. Slab replacement shall extend to third point of framing infill bay and girder span at composite beam systems.

F. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

G. Repair methods not specified above may be used, subject to acceptance of Architect.

3.18 QUALITY CONTROL

A. The Owner will employ an independent testing and inspection agency that meets the requirements of ASTM E329 to perform inspections and tests and to prepare test reports. The agency will monitor concrete quality by means of site and laboratory tests. They will be authorized to reject plastic concrete not conforming to specifications. Failure to detect any

defective materials shall not prevent later rejection when such defect is discovered, or obligate the Architect or Owner for final acceptance.

1. See Section 014110 – Structural Special Inspections and Contract Drawings for testing and inspection to be performed.
2. Test results will be reported in writing to the Architect, Engineer, ready-mix producer and General Contractor within 24 hours after tests.
3. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect.
4. Temperature Control and Monitoring shall be performed the contractor for mass concrete and data shall be submitted to the Special Inspector daily.

    a. If temperature rises and differentials exceed allowables, the contractor shall employee a specialty concrete design engineer to inspect and make recommendations on corrective actions regarding mass concrete at no cost to the owner.

B. The Special Inspector will provide testing of the floor slab F-number tolerances conducted in accordance with the provisions set forth by ASTM E 1155. All tests shall be performed within three working days after concrete placement and prior to any form removal. If in-place floor slabs do not comply with the minimum values shown, the Contractor shall propose remedial measures to bring the surfaces of the floors into compliance. These measures might include grinding, planning, surface repair, retopping, or removal and replacement. Remedial measures shall be approved by the Architect/Engineer prior to the Contractor’s commencement of the work.

C. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03300

BROWN + KUBICAN, PSC

STRUCTURAL ENGINEERS

CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____

City, State: _____

General Contractor: _____

Concrete Contractor: _____

Mix Design Number: _____

Concrete Strength (Mix Type): _____

Use (describe): _____

Design Mix Information

	Check one
Based on Standard Deviation Analysis	
Based on Trial Mix Laboratory Test Data	

Design Characteristics

Density		pcf
Strength		psi (28 days)
Air		%
Slump		inches

If trial mixes are used, the Mix Design is proportioned to achieve f'cr = f'c + 1200 psi (1400 psi for strength higher than 5000 psi at 28 days)

Materials

	Type	Source	Specific Gravity	Weight (lb.)	Absolute Vol. (cu. ft.)
cement					
flyash					
silica fume					
coarse aggregate					
fine aggregate					
water					
other ( )					
			Total		27.0 cu. ft.

Water/Cementitious Ratio (W/C) = _____% (lbs. water /lbs. cementitious)

Admixtures

	Manufacturer	Dosage (oz./cwt)
water reducer		
air entraining agent		
high range water reducer		
non-corrosive accelerator		
other ( )		

Slump before high range water reducer = _____inches
Slump after high range water reducer = _____inches

Standard Deviation Analysis (field experience records)

Number of test cylinders evaluated: _____ Standard deviation (s): _____
k-factor:

Number of Tests	k
15	1.16
20	1.08
25	1.03
≥30	1.00

Required avg. compressive strength (≤5000 psi: Max [f'c + 1.34ks, f'c + 2.33 ks – 500])
(>5000 psi: Max [f'c + 1.34ks, 0.9f'c + 2.33ks]): _____
Actual avg. compressive strength:_____
(Refer to ACI 301 for standard deviation calculation – attach copies of laboratory test reports)

Trial Mix Laboratory Test Data

	Mix #1 (w/c=)		Mix #2 (w/c=)		Mix #3 (w/c=)	
Age	Date	Compressive Strength	Date	Compressive Strength	Date	Compressive Strength
7 days		psi		psi		psi
7 days		psi		psi		psi
28 days		psi		psi		psi
28 days		psi		psi		psi
28 days average	NA	psi	NA	psi	NA	psi

(Refer to ACI 301 for trial mix procedure – attach copies of laboratory test reports)

Required Attachments

	Please check
Coarse aggregate gradation report	
Fine aggregate gradation report	
Laboratory test reports (strength tests)	
Admixture compatibility certification letters	

Ready Mix Supplier

Name and Address:

_____

_____

Phone: _____ Miles from project: _____ Date: _____

SECTION 03313

TIGHTNESS TESTING OF CONCRETE STRUCTURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, and equipment necessary for hydrostatic testing of concrete structures as specified in this Section and as shown on Drawings.

B. Hydrostatically test concrete hydraulic structures which are intended to contain liquid to determine that they are watertight and free of detectable leaks as described herein.

1.02 REFERENCES

A. ACI 350.1R - Tightness Testing of Environmental Engineering Concrete Structures and Commentary.

1.03 SUBMITTALS

A. Contractor shall submit written plan on the testing procedure for each structure to be tested. Plan shall include:

1. Anticipated schedule when structure will be tested.

2. Suggested location where test measurements shall be taken.

3. Source of water to be used during testing.

4. Description of how the structure is to be isolated from connected piping.

5. Method in which test water will be disposed.

6. Possible remediation plans if structure does not comply with watertightness testing.

PART 2 – PRODUCTS

2.01 GENERAL

A. Water: Potable, non-potable or natural moving source.

B. Piping: As required to fill and empty structures.

C. Equipment: As required to fill and empty structures.

PART 3 – EXECUTION

3.01 GENERAL

A. The procedure and sequence of testing shall be subject to review and acceptance by Engineer.

B. Unless otherwise specified or approved in advance by Engineer, tightness testing shall be performed before backfilling, before exterior coating application, before installation of aluminum covers (where applicable), and before connections of access platforms. Liners that are mechanically locked to the surface during the placement of the concrete shall be installed before the hydrostatic tightness testing. Interior liners shall be visually examined for deficiencies and must pass integrity testing. Deficiencies shall be repaired.

C. All testing shall be performed by Contractor in the presence of Owner. Owner shall be notified at least 5 days in advance of the time and place at which testing will be performed.

D. The test measurements shall not be scheduled for a period when a substantial change in the weather pattern is forecast. The test shall also not be scheduled for when the weather forecast indicates that the water surface would be frozen before the test is completed. The groundwater level shall be brought to a level below the top of the base slab and kept at that elevation or at a lower elevation during the test.

E. Provide labor, piping or hoses, and pumping equipment; Testing water shall be from any potable, non-potable, or natural moving source such as a river or stream, but not from any still water source such as a lake or pond, and not from any wastewater source. Following completion of testing work, the water shall be disposed of in a manner acceptable to Engineer and Owner and, unless otherwise permitted by Engineer and Owner, shall not be allowed to enter other parts of the system.

F. At completion of test, Contractor shall fully drain the structure and remove all debris and sediment from the structure. Tank bottom shall be broom cleaned in a manner acceptable to Engineer.

3.02 HYDROSTATIC TESTING OF OPEN OR COVERED STRUCTURES

A. All openings, fittings, and pipe penetrations in the structure shell shall be inspected at both faces of the concrete, if practical. Defective or cracked concrete shall be repaired prior to testing. Pipe Connections or openings to structures, if not provided with valves or gates, shall be temporarily plugged during testing unless approved in advance by Engineer. Temporary bulkheads over pipe openings in walls shall be provided as required for the testing. All structural penetrations shall be monitored before and during the test to determine the watertightness of these appurtenances. If the structure is to be filled using the inlet/outlet pipe, positive means shall be provided to check that water is not entering or leaving though this pipe once the structure is filled to the test level. Leakage at these inlet/outlets shall be repaired prior to testing. No allowance shall be made in the test measurements for uncorrected known points of leakage.

B. Waterstops shall be placed in other locations as indicated on the Drawings and as required to assure the watertightness of all containers of liquids. Special shop fabricated ells, tees and crosses shall be provided at junctions. Waterstops shall be extended at least 6 inches beyond end of placement in order to provide splice length for subsequent

placement. In slabs and tank bottoms, water stops shall be turned up to be made continuous with waterstops at bottom of walls or in walls.

C. Joints between pipe (except cast iron wall pipe) and cast-in-place concrete walls shall be sealed by means of a groove cast completely around the pipe; the groove shall be filled with a quick setting hydraulic compound similar and equal to Waterplug as made by BASF Construction Chemicals mixed and applied in accordance with the manufacturer's instructions.

D. Do not begin filling until after concrete reaches its 28-day design strength or for mass concrete 56-day design strength.

E. The structure shall be filled at a rate not to exceed 4 feet per hour. The structure shall be filled to the test elevation. The test elevation shall be the design maximum liquid level or 4 inches below any fixed overflow level, whichever is lower. The water shall be kept at the test level for at least 72 hours prior to the actual test. After the structure has been kept full for 72 hours, it will be assumed, for the purposes of the tests, that the absorption of moisture by the concrete in the structure is complete.

F. Testing shall not be scheduled for a period when the forecast is for a difference of more than 35°F between the ambient temperature readings at the times of the initial and final level measurements of the water surface. The test shall also not be scheduled when the weather forecast indicates the water surface could freeze before the test is completed. The water temperature shall be recorded at a depth of 18 in., unless otherwise specified, below the water surface at the start and end of the test.

G. The concrete surfaces and concrete joints shall be thoroughly inspected for potential leakage points. Areas of potential leakage shall be repaired before filling the containment structure with water.

H. Measurements of water level and loss will be taken by Contractor each day over the test period. Measurements will be taken from a fixed point on the tank above the water surface. Measurements will be taken at 24-hour intervals to within 1/16 inch.

I. The maximum allowable loss per day (24 hours) shall be 0.05% of the volume. The test period shall be at least the theoretical time required to lower the water surface 3/8 inch assuming a loss of water at the maximum allowable rate. The test period shall not be less than 3 days (72 hours). The test period need not be longer than 5 days (120 hours).

J. For uncovered tanks, precipitation and evaporation shall be measured during the test period. Evaporation shall also be measured in well-ventilated covered tanks. Precipitation and evaporations measurements shall be taken using a floating, restrained, partially filled, calibrated, open container. Shallow pan type measuring devices shall not be permitted.

3.03 REPAIRS

A. If leakage exceeds above-stated quantity, carefully inspect structures for leaks. Repair where necessary. All work in connection with these tests and repairs shall be at the expense of the Contractor.

B. Regardless of test results, if any visible leaks or indications of leaks are found, the structure shall be drained, repaired, and retested to the satisfaction of Engineer.

C. If any leaks, in excess of the specified amount, are not remedied by the Contractor within four weeks of notification by the Engineer, regardless of whether the cause of these leaks is or is not determined, the Engineer shall have the authority to have these leaks repaired by others. The cost of repairs, by others, shall be deducted from monies due or to become due to the General Contractor.

D. After necessary repairs have been made, repeat watertightness test. Owner will not accept tanks or water-holding structures until satisfactory testing has been completed.

END OF SECTION 03313

SECTION 04080
MASONRY ANCHORAGE AND REINFORCEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Continuous wire reinforcement.

B. Masonry anchors and ties.

C. Veneer anchors and ties.

D. Miscellaneous Accessories.

1.2 REFERENCES

A. ACI 530.1/ASCE 6/TMS 602 - Specifications for Masonry Structures.

B. American Society for Testing and Materials (ASTM) A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

C. American Society for Testing and Materials (ASTM) A153/A 153/M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

D. American Society for Testing and Materials (ASTM) A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

E. American Society for Testing and Materials (ASTM) A 276 - Standard Specification for Stainless Steel Bars and Shapes.

F. American Society for Testing and Materials (ASTM) A 185 - Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

G. American Society for Testing and Materials (ASTM) A370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

H. American Society for Testing and Materials (ASTM) A525 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

I. American Society for Testing and Materials (ASTM) A570- Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled.

J. American Society for Testing and Materials (ASTM) A580 - Standard Specification for Stainless Steel Wire.

K. American Society for Testing and Materials (ASTM) A 666 - Specification for Stainless Steel Strip, Plate and Flat Bar for Structural Applications.

L. American Society for Testing and Materials (ASTM) A 951 - Masonry Joint Reinforcement.

M. Canadian Standards Association (CSA) A370 - Connectors for Masonry.

N. Canadian Standards Association (CSA) G30.3 - Cold-Drawn Steel Wire for Concrete Reinforcement.

O. Canadian Standards Association (CSA) A371 - Masonry for Buildings.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

B. [Product Data]: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Blok-Lok Ltd., which is located at: 30 Millwick Dr. ; Weston, ON, Canada M9L 1Y3; Toll Free Tel: 800-561-3026; Tel: 416-749-1010; Fax: 416-749-1017; Email: request info; Web: www.blok-lok.com .

B. Requests for substitutions will be considered in accordance with provisions of Division 1.

2.2 PRODUCTS

A. Wire Reinforcements: New construction and additions.
   1. Reinforcing shall be wire conforming to ASTM A82 and CSA G30.3 complying with applicable building code approval.
   2. Spacing of longitudinal rods shall be approximately 2 Inches (51 mm) less than the nominal wall thickness. Refer to drawings for wall thickness.
   3. Single Wythe Walls:
      a. Heavy Duty: 3/16 inch (4.76 mm) longitudinal wire and 9 ga. (3.66 mm) cross wire.
      b. Hot Dipped Galvanized After Fabrication: Wire; ASTM A82 CSA G30-3. Coating; ASTM A153 Class B2.

B. Continuous Reinforcement Accessories:
   1. Fabricated corner and partition accessories shall be used to form continuous reinforcement around corners and to anchor intersecting walls. Accessory shall be of corresponding type and design to that used in the adjoining walls.
      a. Corner-Lok as manufactured by BLOK-LOK Ltd.
      b. Partition-Lok as manufactured by BLOK-LOK Ltd.

C. Anchors and Ties:
   1. Refer to drawings for wall construction and tie size required.
   2. Finish: Hot Dipped Galvanized: Wire; ASTM A570. Coating; ASTM A525 G165.
   3. Type A Adjustable Tie: BLT-, size as required, as manufactured by BLOK-LOK Ltd.
   4. Channel slot adjustable anchor: BLT3 16 ga. (1.5 mm) as manufactured by BLOK-LOK Ltd.
      a. Hot-dip galvanized.
   5. Channel Slot Adjustable Anchor: BLT3 11 ga. (3.0 mm) as manufactured by BLOK-LOK Ltd.
      a. Hot-dip galvanized.
      b. 11.Corrugated channel slot tie: BLT4 16 ga. (1.5 mm) as manufactured by BLOK-LOK

Ltd.
c. Hot-dip galvanized.
6. Corrugated Channel Slot Tie: BLT4 12 ga. (2.7 mm) as manufactured by BLOK-LOK Ltd.
a. Hot-dip galvanized.
7. Wire Channel Slot Tie: BLT5 as manufactured by BLOK-LOK Ltd.
a. Hot-dip galvanized.
8. Dovetail Slot Anchor: Galvanized BLT8 as manufactured by BLOK-LOK Ltd.
9. Dovetail Wire Tie: Galvanized D/T Flex-O-Lok as manufactured by BLOK-LOK Ltd.
10. Dovetail Strap Tie: Galvanized D/T Masonry Anchor as manufactured by BLOK-LOK Ltd.
11. Masonry Wall Tie: Z Bars BLT6 as manufactured by BLOK-LOK Ltd. 3/16 inch (4.76 mm).
a. Hot-dip galvanized.
12. Masonry Rectangular Wall Tie: BLT7 as manufactured by BLOK-LOK Ltd. 3/16 inch (4.76 mm).
a. Hot-dip galvanized.
13. Column Wall Tie: Column-Lok BLT10 as manufactured by BLOK-LOK Ltd. 3/16 inch (4.76 mm).
14. Masonry Anchor: Hot dipped galvanized BLT11 as manufactured by BLOK-LOK Ltd. 3/16 inch (4.76 mm).

D. Miscellaneous Accessories:
1. Insulation Retainer: Wedge-Lok as manufactured by BLOK-LOK Ltd
2. Insulation Retainer Plate.
a. Hot dip Galvanized.
3. Cell Vent as supplied by BLOK-LOK Ltd.
4. Rubber Extruded Control Joint: Titewall BL-A as manufactured by BLOK-LOK Ltd.
5. PVC Extruded Control Joint Titewall BL-B as manufactured by BLOK-LOK Ltd.
6. Stainless Steel Drip Edge:
a. 1-1/2" wide with 3/8" hemmed drip edge.
b. 3" wide with 3/8" hemmed drip edge.
c. Type 304 SS.
d. Finish 2B/2D.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Continuous Reinforcement.
1. Place reinforcing to assure 5/8 inch (16 mm) minimum mortar cover on the exterior face unless otherwise noted.
2. Provide horizontal joint reinforcement at the top course immediately below roof and floor levels and the first two courses above and below wall openings. The reinforcement shall extend 24 inches (609 mm) beyond openings.
3. Provide continuous reinforcement with 6 inches (150 mm) overlap at all splices. Reinforcement shall not pass through control joints unless otherwise specified. Reinforcement used for bonding wythes only, need not have an overlap at splices; refer to drawings.
4. Set reinforcement on the wall in advance of the mortar and positioned to provide a minimum of 5/8 inches (16 mm) of mortar cover between the reinforcement and the exterior face of the masonry. After the mortar is applied, lift the reinforcement slightly to allow mortar to surround the wires.

5. Space joint reinforcement in the wall in accordance with applicable code requirements, and not less than CAN 3-A370.
6. Follow placement procedures for masonry reinforcement to comply with applicable code requirements, and not less than CAN 3-A370 and CSA 371.

C. Reinforcement and Anchorage - Cavity Wall Masonry:
1. Install wall ties per drawings and details.
2. Place individual wire or sheet metal ties into mortar after the mortar is placed. Prevent hollow spots from forming under sheet material to prevent water penetrating the masonry.
3. Embed anchors attached to structural members. Embed anchors in every second block.
4. Reinforce joint corners and intersections with strap anchors 16 inches (406 mm) on center.

END OF SECTION

SECTION 04222
ARCHITECTURAL CONCRETE MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Architectural concrete masonry exterior single wythe walls.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications.

B. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates.

B. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

C. ASTM C 90 - Standard Specification for Loadbearing Concrete Masonry Units.

D. ASTM C 91 - Standard Specification for Masonry Cement.

E. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

F. ASTM C 140 - Standard Specification for sampling and testing Concrete Masonry Units.

G. ASTM C 150 - Standard Specification for Portland Cement.

H. ASTM C 331 - Standard Specification for Lightweight Aggregates for Concrete Masonry Units.

I. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

J. ASTM C 1019 - Standard Test Method for Sampling and Testing Grout.

K. ASTM C 1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.

L. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.

M. ASTM C 1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

N. ASTM C 1506 - Standard Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters.

O. ASTM D 2000 - Standard Classification System for Rubber Products in Automotive Applications.

P. ASTM D 2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and

Copolymer Molding and Extrusion Compounds

Q. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

R. ASTM E 514 - Standard Test Method for Water Penetration and Leakage Through Masonry.

S. TMS 402-13 / ACI 530-13 / ASCE 5-13 - Building Code Requirements for Masonry Structures.

T. TMS 602-13 / ACI 530.1- 13 / ASCE 6-13 - Specification for Masonry Structures.

U. NCMA TEK Bulletin 3-1C - All Weather Concrete Masonry Construction.

V. NCMA TEK Bulletin 3-2A - Grouting for Concrete Masonry Walls.

W. NCMA TEK Bulletin 3-3A - Reinforced Concrete Masonry Construction.

X. NCMA TEK Bulletin 8-2A - Removal of Stains from Concrete Masonry Walls."

Y. NCMA TEK Bulletin 10-1A - Crack Control in Concrete Masonry Walls.

Z. NCMA TEK Bulletin 10-2B - Control Joints for Concrete Masonry Walls.

AA. NCMA TEK Bulletin 14-4A - Strength Design of Concrete Masonry. [UNICODE CHAR NOT COVERED: 8232]

BB. NCMA TEK Bulletin 19-4A - Flashing Strategies for Concrete Masonry Walls.

CC. NCMA TEK Bulletin 19-5A - Flashing Details for Concrete Masonry Walls.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Concrete Unit Masonry Construction: Comply with the following:
   1. TMS 602-13 / ACI 530.1- 13 / ASCE 6-13 - Building Code Requirements for Masonry Structures.
   2. TMS 602-13 / ACI 530.1- 13 / ASCE 6-13 - Specification for Masonry Structures.
   3. National Concrete Masonry Association (NCMA) TEK Bulletins.

B. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 402/ ACI 530.1/ASCE 5 and TMS 602/ ACI 530.1/ ASCE 6
   2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
   1. Clay Masonry Unit Test: For each type of unit required, according to ASTM C 67 for compressive strength.
   2. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C

140 for compressive strength.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
4. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
5. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
6. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods including written plan for cold and hot weather construction and masonry cleaning procedures.

C. Selection Samples: Submit three full size units of each type/color of exposed architectural concrete masonry unit for review of color and texture to verify compliance with products specified. Provide the maximum color and texture variation range expected in the finished work. Production orders may be released after submittals are approved.

D. Manufacturer's Certificates and Test Reports: Certify products meet or exceed specified requirements. Test reports should be within 12 months of bid date.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in TMS 602/ACI 530.1/ASCE 6.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten years documented experience and a current member in good standing of the National Concrete Masonry Association.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience with projects of similar scope and complexity.

C. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of masonry work while it is in progress.

D. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing

indicated.

E. Source Limitations: Provide each type of masonry unit from a single manufacturing source to ensure uniform texture and color for continuous and visually related items.

F. Mock-Up: Prior to starting masonry work build sample wall panel(s) for Architect's inspection and acceptance. Build panel(s) on a firm foundation, in location acceptable to the Architect. Panel(s) shall be L-shaped, with long side a minimum of 5 foot 4 inches long by 4 foot 0 inches high and with one corner return at least 2 foot 0 inches long. Construct sample panel(s) full thickness, installing wall reinforcement, anchors, ties and other required accessories. Provide special features as directed for control joints, weeps, etc. Panel(s) shall show color range and texture of masonry units, bond, mortar joints and workmanship to be expected for the project.
   1. Build sample panels for:
      a. Each type of exposed unit masonry construction.
      b. Typical exterior wall.
      c. Typical interior wall.
      d. Typical exterior and interior walls.
   2. Clean one-half of each sample panel using approved masonry cleaning materials and methods to represent final cleaning. Remaining one-half to remain without final cleaning for comparison purposes.
   3. Retain sample panels during construction as a standard for judging completed masonry work. Do not alter, move, or destroy sample panels until work is completed or removal is authorized.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural concrete masonry units to the job site on wood pallets with manufacturer's recommended unit protective covers.

B. Inspect architectural concrete masonry units upon delivery to ensure color match with required materials and accepted samples.

C. Stack masonry units in a dry place off the ground on pallets or a prepared plank platform. Method of stacking is acceptable. Protect with non-staining waterproof tarpaulin coverings arranged to allow air circulation around and above masonry units.

D. Exercise care in the storage, handling and installation of masonry units. Do not build soiled or damaged masonry units into the work.

1.9 SEQUENCING

A. Ensure that locating templates and other information required from others for built-in installation of products of this section are furnished in time to prevent interruption of construction progress.

1.10 PROJECT CONDITIONS

A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.

B. Cold Weather Procedures:
   1. Preparation:
      a. If ice or snow has formed on the masonry bed, remove it by carefully applying heat not to exceed 120 degrees F until the surface is dry to the touch.

b. Remove any brick units or mortar that is frozen or damaged.
c. When the clay masonry unit suction exceeds 30 grams per minute per 30 square inches, sprinkle with heated water as follows:
1) When units are 32 degrees F or above, heat water to 70 degrees F or above.
2) When units are below 32 degrees F, heat water to 130 degrees F or above.

2. Work in Progress:
a. Air temperature 40 degrees F to 32 degrees F:
1) Heat sand or mixing water to produce mortar temperatures that match air temperature.
b. Air temperature 32 degrees F to 25 degrees F:
1) Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
2) Maintain temperature of mortar on boards above freezing.
3) Installation in colder air temperatures will require heat sources on the wall and the use of windbreaks or tents to create a controlled environment suitable for proper bonding and curing.

3. Completed Work and Work Not in Progress:
a. Mean daily air temperature of 40 degrees F to 32 degrees F: Protect masonry from rain and snow for 24 hours by covering with a weather-resistive membrane.
b. Mean daily air temperature of 32 degrees F to 25 degrees F: Cover masonry with a weather-resistive membrane for 24 hours.
c. Mean daily air temperature of 25 degrees F to 20 degrees F: Cover masonry with insulating blankets for 24 hours.

C. Hot Weather Procedures:
1. When ambient temperature exceeds 90 degrees F and wind exceeds 8 miles per hour:
a. Maintain temperature of mortar and grout between 70 degrees F and 120 degrees F.
b. Limit the spread of the mortar bed to 4 feet and place units within 1 minute of spreading mortar.
c. Control moisture evaporation in partially or newly completed walls by fog spraying with potable water, covering with opaque plastic or canvas or both.

2. Protection of Work in Progress:
a. Covering:
1) Cover tops of walls with a strong waterproof membrane at the end of each day or work shutdown. Extend the waterproof membrane cover a minimum of 24 inches down the side of each wall.
2) Hold cover securely in place.
b. Load Application:
1) Do not apply uniform floor or roof loading for at least 12 hours after completing columns and walls.
2) Do not apply concentrated loads for at least 3 days after completing columns and walls.
c. Staining:
1) Prevent grout and mortar from staining the face of masonry.
2) Remove grout and mortar that comes in contact with masonry units immediately.
3) Protect sills, ledges and projections from mortar droppings.
4) Protect base of wall from rain-splashed mud and mortar splatter.

5) Turn scaffold boards on edge when work is not in progress to lessen splattering.

D. Coordination: Coordinate Work to ensure top of wall is covered and remains covered until properly block openings are protected with coping or finishing system indicated on the Drawings

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Concrete Products Group, which is located at: 221 Bolivar St. Suite 200; Jefferson City, MO 65101; Toll Free Tel: 800-789-0872; Fax: 763-445-2078; Email: request info (info@concreteproductsgroup.com); Web: www.concreteproductsgroup.com
   1. Regional Manufacturers: Mountain & West:
      a. Basalite Concrete Products, LLC, Dixon, CA, www.basalite.com
      b. Orco Block Co., Inc., Stanton, CA, www.orco.com
      c. Western Block Co., Phoenix, AZ, www.westernblock.com/default.htm
   2. Regional Manufacturers: Midwest
      a. Amcon Block, St. Cloud, MN, www.amconblock.com
      b. Midwest Block & Brick, St. Louis, MO, www.midwestblock.com
      c. Midwest Block & Brick, Kansas City, MO, www.midwestblock.com
      d. Midwest Block & Brick, Tulsa OK, www.midwestblock.com
      e. Oberfields LLC, Lima, OH, www.oberfields. com
      f. Oberfield's Inc., Columbus, OH, www.oberfields.com
   3. Regional Manufacturers: South & Southeast
      a. Block USA - Golf Coast Division, Theodore, AL, www.blockusa. com
      b. Block USA, Birmingham, AL, www.blockusa.com
      c. Headwaters Construction Materials, Houston, TX, www.headwaters.com
      d. Johnson Concrete Company - Salisbury NC www.johnsoncmu.com
   4. Regional Manufacturers: East
      a. A. Jandris & Sons, Inc., Gardner, MA, www.ajandris.com
      b. Allied Concrete Products. LLC, Chesapeake, VA, www.alliedconcreteusa.com.
      c. Barnes & Cone, Syracuse, NY, www.barnesandcone.com
      d. Fizzano Brothers, Crum Lynne, PA, www.fizzano.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Aggregate:
   1. ASTM C 33 normal weight aggregate.[UNICODE CHAR NOT COVERED: 8232]
   2. ASTM C 331 lightweight aggregate.

B. Cement: ASTM C 150, Type required. Color, White/Grey as required for use with the color specified.

C. Water Repellent Admixture: Integral polymeric water repellent admixture for concrete masonry units used in masonry exposed to the exterior.
   1. Performance requirements:
      a. Water resistance: ASTM E 514.[UNICODE CHAR NOT COVERED: 8232]
      b. Flexural Bond Strength: Pass for full wall; ASTM E 72 or C 1072.

c. Fully dispersible in water.

D. Color Pigments: Lightfast, alkali-resistant, weather-resistant natural or synthetic iron oxides manufactured specifically for use in concrete masonry units.

2.3 ARCHITECTURAL CONCRETE MASONRY UNITS

A. Hollow Load Bearing Units: Provide unit type and size(s) indicated on the drawings
   1. Masonry units meeting all ASTM C 90 testing requirements and containing integral mixed color.
      a. Spec-Surface smooth and dense masonry units for painting.
      b. Spec-Split - Splitface masonry units
      c. Polished and Textured specialty masonry units.
      d. Carbon Lean 20 - CMU units with minimum 20 percent reduced carbon footprint.
   2. Unit Weight:
      a. Normal weight units.
      b. Lightweight units.
   3. Linear shrinkage: Not to exceed 0.065 percent, ASTM C 90.
   4. Unit Compressive Strength: Minimum net area compressive strength of 2,000 psi.
   5. Integral Water Repellent Units: All exterior wall architectural concrete masonry units, including single wythe walls and facing units shall be manufactured using the manufacturer's integral polymeric water repellent admixture.
   6. Color:
      a. As selected by Architect from manufacturer's standard colors

B. Special shapes:
   1. Provide closures, jamb units, headers, lintels, bond beams and other special shapes as indicated.
   2. Provide standard manufactured sizes or cut full size units for fractional course height and lengths.

2.4 MASONRY ACCESSORIES

A. Mortar and grout: Provide water repellent admixture for exterior wall mortar and grout.
   1. Water Repellent Mortar Admixture: Exterior wall mortar admixture shall match the manufacturer of the admixture used to produce the masonry units. Coordinate the selection with the masonry unit manufacturer.
   2. Comply with manufacturer's instructions for mixing and mortar preparation.
   3. When using bulk mortar silo's with dry admixture, the admixture in the pre-blended mortar MUST be from the same producer used in the CMU materials.

B. Masonry Anchorage and Reinforcement: Comply with the manufacturer's recommendations.

C. Fabricated Steel Lintels: Comply with Section 05 50 00 - Metal Fabrications.

D. Sheet Metal Flashing and Trim: Comply with Section 07 62 00 - Sheet Metal Flashing and Trim.

E. Flexible Flashing: Comply with Section 07 65 26 - Self-Adhering Sheet Flashing.

F. Foamed-in-place insulation materials and installation: Comply with Section 07 21 29 -

Spray Foam Insulation.

G. Control Joints:
1. Rubber: ASTM D 2000.
2. Vinyl: ASTM D 2287.

H. Weeps: Weeps are to be used in conjunction with flashing materials for proper functioning of the masonry wall drainage system. Specified weep material is:
1. Plastic vents or cells in veneer wall systems.
2. Bloc-Flash, by MortarNet in single wythe walls

I. Masonry Cleaning Materials: Standard-strength proprietary masonry cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new concrete masonry without discoloring or damaging masonry surfaces. Provide cleaning product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units.

J. Masonry Sealing Materials: Provide cleaning material manufacturer's compatible masonry sealer coating for all single wythe concrete masonry exterior walls.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, structure and installation conditions. Do not proceed with architectural concrete masonry work until unsatisfactory conditions have been corrected.

B. Verify items provided by other Sections of work are properly sized and located.

C. Verify that items to be built in are in proper location, and ready for roughing into masonry work.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean substrate surfaces thoroughly prior to installation.

B. Establish lines, levels and coursing. Verify anchors and flashings are correctly located and installed.

C. Furnish temporary bracing as required during installation of masonry work. Maintain in place until building structure provides permanent support.

D. Do not wet concrete masonry units.

E. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. 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 other locations. Split masonry coursing at heads and sills of openings and cut concrete masonry coursing less than 4 inches in height not permitted.

C. Lay up walls plumb and true to comply with specified tolerances. Provide square corners, except as otherwise indicated, with courses level, accurately spaced and coordinated with other work. Use double lines at multiple wythe walls.

D. Pattern bond: Lay exposed concrete unit masonry in running bond with vertical joint in each course centered on units in courses above and below. Bond and interlock each course of each wythe at corners. Do not use units with less than 4 inches of horizontal face dimensions at corners or jambs. Install special shape units where indicated.

E. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings, load bearing walls, all courses of piers, columns and pilasters and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. Maintain 3/8 inch joint widths, except as necessary at base course bed joints, and except for minor variations required to maintain bond alignment

F. Lay solid concrete 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

G. Compress and cut joints flush for masonry walls that are below grade, concealed or covered by other materials.

H. Tool joints in all exposed masonry work to a concave joint when thumb print hard, unless plans indicate otherwise.

I. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

J. Step back unfinished work adjoining new work. Rack back 1/2 unit length in each course; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar before laying fresh masonry.

K. Provide interlocking masonry bond in each course at corners and intersecting walls, unless otherwise indicated on plans such as for stack bond.

L. Load-bearing walls: If carried up separately, provide rigid steel anchors spaced not more than 2 feet on center vertically. Embed ends in mortar filled cores. Build full height of story to underside of structure. Grout juncture with structure solid with grout.

M. Non load-bearing walls: Build full height of story to underside of structure, except as otherwise shown. Terminate full height non load-bearing walls one joint thickness below the structure to allow for deflection of the structural element without loading the wall. Provide an open joint for application of joint sealant.

N. As the work progresses, build in items specified under this and other Sections of the specifications. Fill in solidly with masonry around built-in items.
   1. Bed hollow metal frame anchors in mortar. Align anchors with joint coursing. Draw anchors tight and fill space between hollow metal frames and masonry solid with fine mortar grout.
   2. Where built-in items are to be embedded in cores of hollow masonry units, place

a layer of metal lath or other approved material, in the joint below and rod grout into core.

3. Provide solid masonry bearing for all lintels, beams, joists, plates and load-bearing members.
   a. Provide solid masonry units or hollow units filled solid.
   b. Minimum one block course under steel angle lintels and steel joists not bearing on bond beams.
   c. Minimum two block courses under steel beams and steel beam lintels. Where beams and lintels are parallel with wall, extend solid bearing to walls, extend solid bearing 16 inches each side of centerline of beam.
4. Take particular care to embed all conduits and pipes within concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where electric conduit, outlets, switch boxes and similar items occur, grind and cut units before building in services.
5. Install anchors and reglets for flashing and related work built into masonry work.
6. Install reinforcing steel and grout where indicated. Comply with Drawing details for reinforcing steel size and spacing.

O. Single Wythe walls::
   1. Lay masonry units with full head and bead joints.
   2. Tool both interior and exterior mortar joints
   3. Install all units with "Water Control Technology" (WCT) in proper, "up" position.

P. Horizontal joint reinforcing: Joint reinforcing is specified in Section 04 05 19.29 - Stone Anchors. Install continuous joint reinforcing at all single wythe and back-up concrete masonry walls as follows:
   1. In every second block course, 16 inches on center vertically, full height of wall and every block course where shown on the Drawings.
   2. In the first two bed joints immediately above and below all openings so that it extends a minimum of 24 inches beyond opening each way.
   3. In the bed joints of the first and second courses below the bearing line in bearing walls when wall receives uniformly distributed floor or roof loads in bed joints 16 inches below bond beams.
   4. In parapet walls 8 inches on center vertically, beginning at a point not less than 12 inches below the ceiling line of the heated space below the roof slab.
   5. Lap reinforcement a minimum of 6 inches and full width at corners and intersections or use special fabricated sections.
   6. Cut or interrupt joint reinforcement at vertical movement control or expansion joints, unless otherwise indicated.
   7. Prefabricated metal joint reinforcement shall not be used as wall ties in multiple wythe walls, except for composite wall construction and two adjacent tiers of concrete block.
   8. Fully embed side rods in mortar

Q. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
   1. Provide an open space not less than 1/2 inch width between masonry and structural member. Keep open space free of mortar or other rigid materials.
   2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to the structure. Provide anchors with adjustable tie sections. Space anchors not more than 24 inches on center vertically and 36 inches on center horizontally.
   3. Anchor veneers to concrete structural members with dovetail anchors.

R. Control Joints: Provide control joints for exterior masonry construction.
   1. Provide sash blocks with premolded shear key. Rake out mortar, if any, and form continuous vertical joints in masonry construction to receive joint sealant at the locations listed below.
   2. Locate control joints as indicated on the Drawings.

S. Bond Beams: Install bond beams where indicated. Comply with Drawings for reinforcing steel size and spacing. Fill bond beam masonry units solid with concrete fill or coarse mortar grout. Use smooth dowels to allow for horizontal movement at control joints unless otherwise indicated on the Drawings.

T. Lintels:
   1. Install loose steel lintels furnished under Section 05 50 00 - Metal Fabrications Metal Fabrications where shown. Set lintels in full bed of mortar.
   2. Provide minimum bearing at each jamb of 4 inches for openings for less than 6 feet and 8 inches for wider openings

U. Flashing and weeps: Install flashing as specified in Section 07 62 00 - Sheet Metal Flashing and Trim.
   1. Install concealed through wall masonry flashing at all cavity and veneer wall sills, masonry openings in exterior walls with masonry above head, over all horizontal steel members built into masonry and elsewhere as indicated. Comply with SMACNA "Architectural Sheet Metal Manual" Chapter 4 Flashing recommendations and with NCMA TEK Bulletins 19-4A and 19-5A details to ensure water resistant masonry construction.
   2. Install weeps in head joints of final course of exterior masonry wythe above flashing. Space weeps maximum of 24 inches on center horizontally with exterior ends and located to avoid door openings. Install weeps at head joints with outside face of weep material held 1/8 inch from the finish face of masonry unit.
   3. Install cavity fill on top of base flashing. Install a bed of mortar, conforming to the curve of the flashing, placed under the metal flashing.
   4. Install vents in head joints of final top course exterior masonry veneer wythe. Install at head joints with outside face of vent material held 1/8 inch from the finish face of masonry unit. Space vents 24 inches on center horizontally.
   5. Install compressible joint material at lintels and horizontal steel members. Build in joint fillers and seal with joint sealant specified in Section 07 90 00 - Joint Protection.

3.4 REINFORCED CONCRETE MASONRY

A. Fill scheduled wall and column masonry work. Fill all cores solid with concrete fill/coarse masonry grout as specified.
   1. Grouting: Comply with TMS 602 grout placement requirements. Consolidate grout at time of placement.
      a. Low-Lift Grouting: Place concrete fill/coarse masonry grout in maximum 5 foot vertical lifts.
      b. High-Lift Grouting (If Approved): Place concrete fill/coarse masonry grout in maximum 12 foot vertical lifts (Recommend the use of super plasticizer with hi-lift grout).
   2. Recess top of grout fill minimum 1-1/2 inches below top of course to form a key with following lift.
   3. Where vertical reinforcing is required, install reinforcing before filling operation. Wet sticking of reinforcing is not permitted. Comply with Drawing details for reinforcing steel size and spacing.

B. Install bond beams where indicated. Install reinforcing before filling operation. Fill units solid with grout. Comply with drawing details for reinforcing steel size and spacing.

3.5 REPAIR AND POINTING

A. Clean and point exposed architectural concrete masonry at end of each working day. Remove and re- place masonry units that are loose, chipped, broken, stained, or otherwise damaged. Provide new units to match adjoining units and install in fresh mortar pointed to eliminate evidence of replacement.

B. During the tooling of joints, enlarge any voids or holes, except weeps and completely fill with mortar. Point up all joints at corners, openings and adjacent work to provide a neat, uniform appearance. Remove line pins and fill all line pin holes.

C. Wipe off excess mortar as the work progresses. Dry brush with bristle brushes exposed masonry at the end of each day's work. Remove mortar spatters and joint ridges.

3.6 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
   1. Begin masonry construction only after inspectors have verified proportions of site- prepared mortar.
   2. Place grout only after, inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.7 CLEANING

A. Cut out defective mortar joints and holes in exposed masonry and re-point with mortar.

B. Clean a sample wall panel with approved cleaner. Only proceed with cleaning after sample panel has been approved by the Architect.

C. Clean architectural concrete masonry in accordance with the masonry manufacturer's and the proprietary cleaning product manufacturer's recommendations.

D. After cleaning allow units to dry and when specified apply a sealer that is recommended by the local Concrete Products Group manufacturer.

3.8 PROTECTION

A. Protect installed products until completion of project.
   1. Protect top of wall until covered or capped to a waterproof condition by subsequent construction.
   2. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that comes in contact with such masonry
   3. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
   4. Protect sills, ledges, and projection from mortar splatter and dropping.
   5. Protect surfaces of windows and door frames; as well as similar products with painted and integral finishes from mortar splatter and dropping

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following metal fabrications:

Rough hardware
Loose bearing and leveling plates
Loose steel lintels
Miscellaneous framing, supports and trim
Steel pipe guardrails and handrails

B. Related Sections: Refer to Section 05120, "Structural Steel" for structural steel framing components.

1.02 DEFINITIONS

A. Refer to ASTM E985 for railing-related terms that apply to this section.

B. Refer to the NAAMM publications listed in Article 1.02 "References" for definition of terms that apply to this section.

1.03 SUBMITTALS

General: Submit the following in accordance with Conditions of Contract.

A. Product Data: Submit product data for products used in metal fabrications, including paint products, grout and fasteners.

B. Shop Drawings: Submit detailed shop and erection drawings of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified in 1.05C.

E. Qualification data for firm specified in 1.04B to demonstrate their capabilities and experience.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated. Where conflicts occur, comply with the more stringent requirements.

1. ANSI 14.3

2. AWS D1.1 and D1.3

3. NFPA 101

B. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that shown on the drawings, with sufficient production capacity to produce required units without causing delay in the work.

C. Qualify welding processes and welding operators in accordance with AWS D1.1 and D1.3.

Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

D. All materials used shall be free of lead, and asbestos fibers.

E. Use of damaged items is prohibited except by specific authorization of Sandia Delegated Representative (SDR) in writing.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

B. Storage on Site: Store materials in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.

Store metal components and materials in a clean, dry location. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that will permit circulation of air inside the cover.

C. Keep handling on-site to a minimum. Exercise care to avoid damage to finishes of material.

1.06 PROJECT CONDITIONS

Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.07 SEQUENCING AND SCHEDULING

Sequence and coordinate installation of wall handrails as follows:

A. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.

B. Mount handrails only on gypsum board assemblies reinforced with proper blocking and backing to receive anchors, and where the location of concealed anchor plates has been clearly marked for benefit of Installer.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. Metal Surfaces, General: Form metal fabrications exposed to view upon completion of the work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A36.

C. Rolled Steel Floor Plates: ASTM A786.

D. Steel Bars for Gratings: ASTM A569 or ASTM A36.

E. Wire Rod for Grating Cross Bars: ASTM A510.

F. Steel Tubing: Cold-formed, ASTM A500, Grade B, unless otherwise indicated.

G. Uncoated Structural Steel Sheet: Hot-rolled, ASTM A570, Grade 30 unless otherwise indicated.

H. Uncoated Steel Sheet (Commercial quality): Cold-rolled, ASTM A366.

I. Galvanized Steel Sheet: Quality as follows:

1. Structural Quality: ASTM A446; Grade A, unless another grade required for design loading, and G90 coating designation unless otherwise indicated.

2. Commercial Quality: ASTM A526, G90 coating designation unless otherwise indicated.

J. Steel Pipe: ASTM A53, Type S, Grade B, standard weight (schedule 40), black finish, unless otherwise indicated.

K. Gray Iron Castings: ASTM A48, Class 30.

L. Malleable Iron Castings: ASTM A47, Grade 32510.

M. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

N. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A153.

O. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.02 GROUT

Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107 (formerly referenced as CE CRD C621). Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to the following:

Euco N-S Grout - Euclid Chemical Co.
Kemset - Chem-Masters Corp.
Crystex - L & M Construction Chemicals, Inc.
Sonogrout - Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
Supreme Grout - Cormix, Inc.
Sure-Grip High Performance Grout - Dayton Superior
Vibropruf #11 - Lambert Corp.

2.03 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required. Suspect/counterfeit bolts will not be accepted and will be replaced at Contractor's expense.

B. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.

C. Lag Bolts: Square head type, FS FF-B-561.

D. Machine Screws: FS FF-S-92.

E. Wood Screws: Flat head carbon steel, FS FF-S-111.

F. Plain Washers: Round, carbon steel, FS FF-W-92.

G. Expansion Anchors: Expansion anchors complying with FS FF-S-325.

H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

J. Special Fasteners: Split nuts, indicator washers and others, as indicated.

2.04 PAINT

A. Shop Primer for Ferrous Metal: Red oxide, lead- and cadmium-free, corrosion-inhibiting primer complying with performance requirements of FS TT-P-664.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94% zinc dust by weight, and complying with MIL-P-21035 or SSPC-Paint-20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint-12 except containing no asbestos fibers.

D. Zinc Chromate Primer: FS TT-P-645.

2.05 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

Temperature change (Range): 100 deg F (38 deg C).

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch (0.794 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to 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.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matched those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

J. Shop Assembly: Preassemble items 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.

K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.06 ROUGH HARDWARE

Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required. Fabricate items to sizes, shapes, and dimensions required.

2.07 LOOSE BEARING AND LEVELING PLATES

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.

2.08 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for opening and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches (203 mm) bearing at each side of openings, unless otherwise indicated.

2.09 MISCELLANEOUS METAL ITEMS

A. Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated which are not a part of structural steel framework, as required to complete work.

1. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

Except as otherwise indicated, space anchors 24 inches (61 cm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4" wide x 1/4" x 8" long (31.8 mm x 6.4 mm x 203 mm).

B. Miscellaneous Steel Trim: Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination for assembly and installation with other work.

2.10 STEEL PIPE GUARDRAILS AND HANDRAILS

A. General: Fabricate pipe guardrails and handrails to comply with requirements indicated for dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage.

B. Interconnect guardrails and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, weld all around and grind smooth.

C. Form changes in directions of railing members as follows:

1. By use of welded prefabricated steel elbow fittings.

2. By bending, of radius indicated.

3. By mitering at elbow bends.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

F. Close exposed ends of pipe by welding 3/16 inch (4.8 mm) thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch (6.4 mm) or less.

G. Toe Boards: Where indicated, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or if not indicated, use 4 inches high x 1/4 inch (102 mm x 6.4 mm) steel bar welded to each railing post.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of guardrails and handrails to other work. Furnish inserts and other anchorage devices for connecting guardrails and handrails to concrete or masonry work.

1. For railing posts set in concrete, fabricate sleeves from steel pipe not less than 6 inches (152 mm) long and with an inside diameter not less than 1/2 inch (12.7 mm) greater than the outside diameter of post, with steel plate closure welded to bottom of sleeve.

2. For removable railing posts, fabricate slip-fit sockets from steel pipe whose inside diameter is sized for a close fit with posts and to limit deflection of post without lateral load, measured at top, to not more than 1/12 of post height. Provide socket covers designed and fabricated to resist accidental dislodgement.

I. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fills to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

J. Design Requirements:
1. Railing shall comply with all requirements of the ADA and OSHA regulations.
2. Provide metals free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

K. Structural Requirements:

3. Handrail, wall rail and guardrail assemblies and attachments shall resist a minimum concentrated load of 200 pounds (91 kg) applied in any direction at any point on the top rail and a vertical and horizontal thrust of 50 lb/lf (0.73 kN/m) applied to the top railing without permanent set or damage. The two loads are not cumulative.
4. Infill area of guardrail system capable of resisting a horizontal concentrated load of 200 pounds applied to one square foot (8165 g/sq. m) at any point in the system. This loading shall not be applied simultaneously with other loading conditions.
5. Handrail assemblies and guards shall be designed to resist a load of 50 pounds per linear foot (0.73 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure.

2.11 FINISHES

A. General: Comply with NAAMM AMP 500 "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL FINISHES

A. General: Shop-paint uncoated surfaces of metal fabrications, except those to be embedded in concrete or masonry or to receive sprayed-on fireproofing, surfaces and edges to be welded, and galvanized surfaces, unless otherwise indicated. Comply with requirements of SSPC-PA 1 for shop painting.

B. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process in compliance with the following requirements:

1. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forced shapes, plates, bars, and strip 0.0299 inch (0.7595 mm) thick and heavier.

2. ASTM A153 for galvanizing iron and steel hardware.

C. Surface Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below.

1. Remove oil, grease and similar contaminants in accordance with SP-1, "Solvent Cleaning".

2. Remove loose rust, scale, spatter, slag and other deleterious materials in accordance with SSPC, utilizing the following methods as required:

SP-2 "Hand-Tool Cleaning"
SP-3 "Power-Tool Cleaning"
SP-7 "Brush-Off Blast Cleaning"

D. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 3.0 mils (0.076 mm). Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection.

2.13 ALUMINUM FINISH

Mill (as fabricated) finish, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

Installer shall examine the areas and conditions under which metal fabrication items are to be installed. Notify the SDR in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer and SDR.

3.02 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.

C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.03 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. 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 the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arch welding, appearance and quality of welds made, methods used in correcting welding work, 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.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surfaces matches those adjacent.

F. Grout: Follow manufacturer's recommendations for substrate preparation and application.

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 or zinc chromate primer.

3.04 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 INSTALLATION OF STEEL PIPE GUARDRAILS AND HANDRAILS

A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

1. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's directions.

2. Anchor posts and rail ends to steel with welded connections, unless otherwise indicated.

3. Anchor posts and rail ends into concrete and masonry with steel round flanges welded to post and rail ends, and anchored into wall construction with expansion shields and bolts.

4. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2 inch (38.1 mm) clearance from inside face of handrail and finished wall surface. Locate brackets at spacing not less than 5'-0" (1.5 m) o.c., unless otherwise indicated. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.

3. For hollow masonry anchorage, fasten brackets directly on masonry wall using toggle bolts.

4. For steel framed gypsum board assemblies, fasten brackets to wood blocking using lag bolts or to metal blocking using self-tapping screws, of size and type required to support structural loads.

C. Expansion Joints: Provide expansion joints at locations indicated, or if not indicated, at intervals not to exceed 40 feet (12.2 m). Provide slip joint with internal sleeve extending 2 inches (51 mm) beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches (152 mm) of posts.

3.06 ADJUSTING AND CLEANING

A. Touch-Up Painting of Steel Items: Immediately after erection, clean field welds, bolted connections, abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.

Apply by brush or spray to provide a minimum dry film thickness of 3.0 mils (0.076 mm).

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION

SECTION 06200
FINISH CARPENTRY

1.01 WORK INCLUDED:

A. All labor, materials, tools and equipment to furnish and install all architectural woodwork including interior trim, shelving, cabinetry, laminated resinous covered items, and necessary fittings, accessories and hardware.
B. Install all Doors, furnished from Division 8.
C. Install Finish Hardware, furnished from Division 8.
D. Install Specialties furnished from Division 10.

1.02 QUALITY STANDARDS:

Quality Standards (Section 100 through 1500 inclusive) of the Architectural Woodwork Institute, 1808 West End Building, Nashville, Tennessee, shall apply to all material and workmanship furnished under this section and are hereby made a part of this specification as if copied verbatim herein. Moldings are to be true to details, cleanly cut and sharp. Exposed surfaces are to be sanded to a smooth, even surface ready for finish. Provide sufficient clearance for doors and drawers of casework to prevent sticking after painting but avoid excessive tolerances.

1.03 SHOP DRAWINGS:

Furnish four (4) sets of shop drawings of all materials except where shown in full size on Architect's drawings. If full size details on Architect's drawings do not show joinery or if supplier desires to vary joinery (not profiles) to accommodate mill practices, shop drawings must be furnished.

1.04 FIELD DIMENSIONS:

The Contractor is responsible for the proper fitting of all work to job conditions and shall take all measurements to assure this fit.

1.05 DELIVERY AND STORAGE:

Do not deliver until the material can be properly stored under cover and sufficiently dry to avoid excessive changes in moisture content, curling, or warpage.

2.01 MATERIALS:

A. Interior Wood Trim for doors, windows, base, crown and miscellaneous: AWI Custom Grade Poplar or clear White Pine for all woods receiving clear, natural finishes; Custom grade white pine or poplar may be used for trim to have opaque paint finish.
B. Cabinetry: Plastic laminate cabinetry, see Section 06400.

3.01 INSTALLATION, GENERAL:

A. Furnish all rough hardware required to securely fasten all wood members in place to plumb and level lines. Countersink all exposed fasteners for exposed wood members.

B. Work shall be assembled at the mill insofar as it is practical and delivered to job ready for installation. When it is necessary to cut and fit on the job, materials shall be made with ample allowance for cutting.
C. Back-prime all wood to be paint finished with one coat white primer. All wood to have transparent finish shall receive one coat shellac before installation except no shellac is to be

applied to finish faces of oil finished wood.

D. Metal and wood doors shall be set to frames to fit properly with normal tolerances. Doors shall swing free and not be hinge bound.

E. Receive materials from Division 10 Contractor and install where shown on the drawings and in accordance with manufacturer's instructions. All installed materials and equipment shall operate to intended function.

3.02 INSTALLATION OF FINISH HARDWARE:

A. Install all items of Finish Hardware furnished in Section 08700 as required to make a complete, finished installation.

B. Approval of schedules and samples will not relieve this Contractor from furnishing all hardware required whether specifically mentioned or not on drawings and herein.

C. Installation: All hardware is to be done by skilled craftsmen in a first-class manner so that all items operate in the manner for which they were designed. All strikes and butts are to be installed flush unless otherwise shown or specified. Improper installation of hardware which causes exposed imperfections in door surfaces will be cause for rejection and replacement of the door. Surface mounted items such as door closers, holders, pulls, etc. are to be installed with thru sex bolts with non-removable heads. Butt pins in out-swinging doors are to be non-removable. Specified hardware has been checked for compatibility and if other manufacturers' hardware is supplied for those items, they must be compatible also.

3.03 CLEANING:

A. All installed materials are to be in working order and lubricated.

B. All materials are to be clean and free of marks, dust and dirt. Clean all cabinets.

C. Clean hardware of dirt and excess oil. Protect during work by others.

END

SECTION 07100
WATERPROOFING

1.1 SUMMARY:

A. Section Includes:
1. Application of exterior below grade liquid, cold-applied elastomeric waterproofing membrane system designed for use on concrete and masonry substrates.

1.2 SYSTEM DESCRIPTION:

A. Performance Requirements: The following properties are based on product's standard system.
1. Minimum Recovery: 90 percent.
2. Swelling in Water (3 days at room temperature): None.
3. Service Temperature Range:
   a. Minimum: Minus 40 degrees F (Minus 40 degrees C).
   b. Maximum: 120 degrees F (49 degrees C).
4. Hardness, Shore OO: 85, ASTM C836
5. Tensile Strength: 150 psi (1.0 MPa), ASTM D412.
6. Average Elongation: 600 percent, ASTM D412.
7. 100 Modulus: 80 psi (0.6 MPa), ASTM D412
8. Moisture-Vapor Permeability (dry perms): 0.1, ASTM E96.
9. Crack Bridging Test: Passed 1/16 inch (2 mm); ASTM C836
10. Extensibility After Heat Aging: No cracking, ASTM C836.
11. Weight Loss (20 percent maximum): 16 percent, ASTM C836.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's technical bulletins and MSDS on each product.

B. Submit list of project references as documented in this Specification under Quality Assurance Article. Include contact name and phone number of person charged with oversight of each project.

C. Quality Control Submittals:
1. Provide protection plan of surrounding areas.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store tightly sealed coating system materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

D. Store in unopened containers in clean, dry conditions at 40 degrees F (4 degrees C) to 80 degrees F (27 degrees C).

1.5 PROJECT CONDITIONS:

A. Environmental Requirements:
   1. Ensure that substrate surfaces are dry, and ambient air temperatures are 40 degrees F (4 degrees C) to 90 degrees F (32 degrees C) at application time and remain above 40 degrees F (4 degrees C) for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.
   2. Do not apply coatings if snow, rain, fog, and mist is anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with coating application.
   3. Do not apply over sealant joints, control joints, or other materials that will be affected by solvent.
   4. Avoid application when inclement weather is present or imminent.
   5. Do not apply membrane to reinforcing bars or to wet or contaminated surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with requirements, provide products from the following manufacturer:
   1. Degussa Building Systems
      889 Valley Park Drive
      Shakopee, MN 55379
      Customer Service: 800- 433-9517
      Technical Service: 800-243-6739
      Direct Phone: 952-496-6000
      Internet: www.degussabuildingsystems.com

B. Specifications and Drawings are based on manufacturer's proprietary literature from Degussa Building Systems. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Architect will be sole judge of appropriateness of substitutions.

2.2 MATERIALS:

A. One-component, moisture-curing, bitumen-modified polyurethane, elastomeric waterproofing membrane for exterior below-grade, between slab applications, or cavity wall construction, available in 4 grades for application by trowel, squeegee, roller, and spray.
   1. Acceptable Product: HLM 5000® by Degussa Building Systems.

B. Color: Black.

2.3 ACCESSORIES:

A. Protection Board: Rigid insulation, see drawings.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION;

A. Lightly steel trowel concrete deck to flat, uniform surface. Light broom finish is acceptable. Properly cure new concrete minimum of 14 days. Mechanically remove membrane-curing compounds.

B. For extremely porous block, apply parge coat of cementitious block filler or prime with a coat of waterproofing membrane diluted up to 25 percent with reducer recommended by membrane manufacturer. Apply cementitious block filler at a rate of approximately 400 square feet (37 square m) per bag for parge coat. Allow curing minimum of 7 days before applying waterproofing membrane.

C. Patch voids and deep depressions in substrates with appropriate patching material before applying waterproofing membrane.

D. Before applying waterproofing membrane, dam drains and drain openings.

E. Carefully work material over irregular concrete to avoid pinholes and holidays

F. Remove dust, dirt, and other contaminants just before or during application. Ensure surfaces are dry at the time of application.

G. Open air-void pockmarks or honeycombs up to allow waterproofing membrane to fill cavities completely. Air entrapment within voids may cause blisters. Extreme cases may require a parge coat.

3.2 PRESTRIPING:

A. Before applying final membrane, seal joints, cracks, and openings around protrusions by caulking or prestriping (a preliminary coating of waterproofing membrane applied with trowel or stiff bristled brush). Allow drying overnight before applying final membrane.

B. When final membrane is applied, verify overall thickness over joints and cracks, at coves, and around penetrations of approximately 100 wet mils (2.5 mm) on standard system, or approximately 200 wet mils on high build system.

C. Static Joints and Cracks: Fill joints and cracks less than 1/16 inch (1.6 mm) by prestriping. Apply material so it both fills and overlaps joint or crack to 4 inch (102 mm) width on each side.

D. Working or Expansion Joints:
1. Seal joints over 1/8 inch (3 mm) with joint sealant. Rout moving joints less than 1/8 inch (3 mm) to 1/8 inch (3 mm) minimum and fill with joint sealant. Prevent waterproofing membrane from adhering to joint sealant, which could cause sealant or membrane failure, by applying coat of wax or teflon tape over cured sealant and then prestriping.

E. Metal:
1. Clean metal to bright metal by wire brush or sandblast. Prime with quality rust-inhibiting metal primer before application of waterproofing membrane.

F. Vent, Drain Pipe, and Post Penetrations:
1. Clean metal surfaces to bright metal and prime with quality rust-inhibiting metal primer. Remove dust, debris, and other contaminants from voids. Seal with appropriate joint sealant.
2. Seal openings exceeding 1/8 inch (3 mm) with joint sealant. Next, prestripe to 4 inch (102 mm) minimum width on base slab and continue up penetration to height of top-course wearing surface.

3.3 APPLICATION:

A. Standard System:
1. For horizontal applications, empty contents of pail and spread immediately to ensure workability. Best results are obtained by marking off 125 square foot (11.61 square m) areas and evenly spreading contents of 5 gallon (18.93 L) unit with rubber-edged notched squeegee. Repeat above procedure until entire surface is covered.
2. For vertical applications, apply by trowel, roller, or spray at rate of 25 square feet per gallon (0.6 square m per L). Best results are obtained by marking off 125 square foot (11.61 square m) areas and evenly applying contents of 5 gallon (18.93 L) pail.
3. Verify applied thickness with wet mil gauge as Work progresses.

B. High-Build System:
1. Concrete Substrate: Apply 60 wet mils (1.5 mm) of waterproofing membrane, followed by setting reinforcing fabric into wet material. Overlap seams 3 inches (76 mm) minimum. Additional material

may be required to properly embed reinforcing fabric where it overlaps. Allow first coat to cure overnight and follow with second 60 wet-mil (1.5 mm) application of waterproofing membrane.

2. Plywood Substrate: Comply with APA (American Plywood Association) standards for plywood construction. Seal joints with recommended joint sealant then proceed with waterproofing membrane high-build system.

3.4 INSTALLATION OF PROTECTION COURSE:

A. Install tightly butted protection board as soon as possible following cure of membrane. Protect membrane from traffic before placement of protection board. Ensure waterproofing membrane has cured before installation of topping.

B. Where hot bituminous topping is to be applied over the 1/4 inch (6 mm) thick protection board, cover butt joints with flexible tape. Minimum topping thickness is 3 inch (76 mm), as recommended by Asphalt Institute, in order to minimize crack reflection.

3.5 CURING;

A. Appreciable properties develop within 24 to 48 hours at 75 degrees F (24 degrees C) and 50 percent relative humidity. Protect waterproofing membrane from traffic during curing.

B. Drainage and Protection:

1. For protection during backfill and where hydrostatic pressure is anticipated, use appropriate drain board system.
2. For protection during backfill only, install protection board as soon as possible following cure of waterproofing membrane.

3.6 FIELD QUALITY CONTROL:

A. Site Tests:

1. Test integrity of cured membrane on horizontal surface by damming entire area and flooding with water to minimum depth of 2 inches. Allow water to stand for 24 to 48 hours. Visually inspect bottom surface to check for water penetration. If repairs are necessary, drain area and allow drying before reapplying waterproofing membrane. After reapplication, test area again for membrane integrity. Repeat procedure until no leaks appear in membrane.

3.7 CLEANING AND PROTECTION:

A. Remove temporary coverings and protection from adjacent Work areas. Clean up areas not to be coated of over-spray and droppings. Remove construction debris from project site.

B. Clean tools and equipment immediately after application with manufacturer's recommended cleaning solution.

END

SECTION 07211
FOAM BOARD INSULATION

GENERAL

1.0 SUMMARY

Section Includes: Provide extruded polystyrene rigid board insulation for foundation perimeter.

2.0 REFERENCES

Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:

American Society for Testing of Materials (ASTM):

- ASTM C 578: Standard Specification for Rigid Cellular Polystyrene Thermal Insulation.
- ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

International Code Council Evaluation Service (ICC-ES), Evaluation Report.

3.0 SUBMITTALS

Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.

Sustainable Design: Submit manufacturer's sustainable design certifications as indicated.

Warranty: Submit documentation for limited product warranty.

4.0 QUALITY ASSURANCE

Source Limitations: Obtain exterior building insulation through one source from a single manufacturer.

Each insulation board must be labeled with manufacturer's name, product brand name, ASTM material specification reference, and identification of the third party inspection agency used for building code qualification.

5.0 DELIVERY, STORAGE, AND HANDLING

Deliver materials in manufacturer's original packaging.

Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.

In the event the board insulation becomes wet, wipe dry prior to installation.

PRODUCTS

MANUFACTURER

Owens Corning Insulating Systems, LLC, Toledo, OH 43659; www.owenscorning.com.

FOAM PLASTIC BOARD INSULATION

Extruded Polystyrene Board Insulation: Comply with ASTM C 578, Type [VII, 60 psi minimum compressive strength, 2.20 lb/cu. ft. (35 kg/cu. m)]

Thermal Resistance: (180 day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F): [R-5.6] per inch of thickness, with 90% lifetime limited warranty on thermal resistance.

Blowing Agent Formulation: Zero ozone depleting.

Edge Condition: [Square, Tongue & Groove, Ship-Lap].

Surface Burning Characteristics (ASTM E 84): Flame spread less than 25, smoke developed less than 450, certified by independent third party such as Underwriters Laboratories (UL).

Indoor Air Quality: Compliance certified by independent third party such as GREENGUARD Indoor Air Quality Certified® and/or GREENGUARD Children and Schools Certified℠.

Recycled Content: Minimum 20%, certified by independent third party such as Scientific Certification Systems.

Warranty: Limited lifetime warranty covering all ASTM C578 physical properties.

Panel Size: Provide 1.5” thick x size indicated on the drawings.

END OF SECTION

SECTION 07600
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: This section includes furnishing and installing flashing and sheet metal as indicated on Contract documents and by provisions of this section.

B. Section Does Not Include:

1. Flashings which are integral with membrane roofing or waterproofing systems (base flashings).

2. Flashings which are integral with prefabricated roof accessories and equipment.

3. Wood blocking, nailers, edge strips, and battens.

C. Related Sections:

1. Section 04 00 00, “Masonry”

2. Section 07 90 00, “Caulk and Sealants”

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

A526 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

A527 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality

A755 Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

A792 Specification for Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

B32 Specification for Solder Metal

B. Factory Mutual Systems (FM)

Loss Prevention Data Sheet 1-49 Perimeter Flashing

C. Federal Specification (FS)

TT-C-494 Coating Compound, Bituminous, Solvent Type, Acid Resistant

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Architectural Sheet Metal Manual

1.03 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Section 01300, "Descriptive Submittals."

B. Product Data: Submit manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

C. Samples for Initial Selection Purposes: Submit manufacturer's color charts and texture variations for specified sheet materials to be exposed as finished surfaces.

D. Provide written certification that all materials used are asbestos-free and lead paint- free.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed flashing, sheet metal, and trim work similar in material, design, and extent to that indicated for project that have resulted in construction with a record of successful in-service performance.

B. Quality Standard: Fabricate and install sheet metal work in accordance with Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) "Architectural Sheet Metal Manual," unless specifically indicated otherwise.

C. Wind Resistance: Fabricate and install flashings at edges of roof in accordance with FM Loss Prevention Data Sheet 1-49 for specified wind zone. Ensure that substrate construction is also in compliance.

D. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Temperature Change Range: 120ºF (67º C), ambient; 180ºF (100º C) material surfaces. Water Filtration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Products made by the following manufacturers will be among those considered acceptable, however, it is the Contractor's responsibility to provide only products compatible with adjacent materials in the assembly.

ATAS Aluminum Corporation
Copper Sales, Inc.
Fry Reglet Corporation
Keystone Flashing Company
MM Systems Corporation
Petersen Aluminum Corporation
Integris Metals

2.02 MATERIALS

A. General: Unless otherwise indicated on Contract documents, provide Aluminum-Zinc Alloy-Coated Steel Sheet , as standard material with a fluoropolymer “Kynar 500” or “Hylar 5000” factory finish.

B. Galvanized Steel Sheet: ASTM A526, G90, commercial quality, or ASTM A527, G90, lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper.

1. Finish: Mill phosphatized (paint-grip).

2. Color: Selected from manufacturer’s standard color selection at time of submittals.

C. Aluminum-Zinc Alloy-Coated Steel Sheet : ASTM A792, Class AZ-50 coating, grade 40, or to suit project conditions, with 55 percent aluminum, not less than 0.0336 inch (0.85 mm) thick, unless otherwise indicated.

1. Finish

a. Mill finish.

b. Coil-Coated Fluoropolymer Factory Finish “Kynar 500” or “Hylar 5000.”

2. Color: Selected from manufacturer’s standard color selection at time of submittals.

3. Provide strippable plastic protective film on pre-painted surfaces.

D. Prepainted, Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial quality steel sheet conforming to ASTM A755, G90 coating designation, coil-coated with high performance flouropolymer coating.

1. Finish: Coil-coated factory finish “Kynar 500” or “Hylar 5000.”

2. Color: Selected from manufacturer’s standard color selection at time of submittals.

3. Provide strippable plastic protective film on pre-painted surfaces.

2.03 REGLETS

A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counter-flashing pieces and compatible with flashing indicated.

B. Surface Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

C. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

D. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

E. Masonry Type: Provide with offset top flange for embedment in masonry mortar joints.

F. Counter-flashing Wind-Restraint Clips: Provide hold down clips with 1/2 inch (12.7 mm) kick-out to be installed before counter-flashing to prevent wind uplift on the counter-flashing lower edge. Fabricate the clips of the following materials:

Galvanized Steel: 22 gage; 0.0336 inch (0.8534 mm) thick.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: For use with steel, furnish lead-free solder complying with ASTM B32, with rosin flux.

B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

C. Mastic Sealants: Polyisobutylene; Non-hardening, non-skinning, nondrying, non-migrating sealant.

D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed; Non-corrosive; Size and thickness required for performance.

E. Installation Accessories: Provide joint tape, adhesives, sealers, and fasteners as recommended by flashing manufacturer for indicated applications.

F. Bituminous Coating: Heavy bodied, sulfur-free, asphalt-based paint; FS TT-C-494.

2.05 FABRICATION, GENERAL

A. Sheet metal fabrication standard: Fabricate sheet metal flashing and trim to comply with recommendation of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal work 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.

D. Seams: Fabricate nonmoving seams in sheet metal flat-lock seams.

E. Sealed Joints: Form non-expansion, but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

F. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within twenty four (24) inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flange, not less than one (1) inch (25 mm) deep filled with mastic sealant concealed within joints.

G. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by SMACNA or sheet metal manufacturer.

Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

J. Form a one-half inch (12.7 mm) hem on underside of exposed edges.

2.06 SHEET METAL FABRICATIONS

A. General: As a minimum, fabricate flashings using materials in the thickness listed for each flashing application.

B. Exposed Flashings-Low Slope Roofs or Waterproofing: Formed copings, gravel stops and scuppers:

1. Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

2. Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

3. Pre-painted Coil-Coated Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

C. Semi-concealed Flashings-Low Slope Roofs or Waterproofing: Counter flashing, reglets, equipment support flashing, roof area joint and roof expansion joint covers and pipe/conduit penetration flashing:

1. Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

2. Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

3. Pre-painted Coil-Coated Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

D. Miscellaneous Flashings

1. Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

2. Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

3. Pre-painted Coil-Coated Galvanized Steel Sheet: 24 gage (0.0276 inch) (0.7010 mm).

E. Gutters and Downspouts

1. Fabricate from same material and finish used for adjacent exposed flashings.

2. Form sheet metal to profile dimensions indicated, free from distortions and defects detrimental to water-tight system.

3. Provide expansion joints in gutters at spacing not to exceed 30 feet (9 m). Drain each section to allow water to drain that is otherwise trapped by expansion joint ridges.

4. Provide removable debris screens for gutters, fabricated from 1/4 inch (6.35 mm) mesh wire cloth of same material used for gutters or approved compatible material. Provide formed sheet metal frame on 4 sides of each screen unit. Length of screen units not to exceed 10 feet (3 m).

5. Provide wire basket type strainers at downspouts, fabricated from wire and sheet metal of same material used for downspouts or approved compatible material.

6. Provide sheet metal baffles 6 inches (152 mm) high with legs 18 inches (457 mm) long at gutter corners below roof valleys.

7. Provide Sandia National Laboratory's Standard Drawing No. AE5013STD for precast concrete splash blocks at downspout discharge.

8. Provide formed metal splash pans fabricated from same type of sheet metal used for downspouts. Locate where downspout discharges onto lower roof.

9. Gutter supports: Brackets spaced at 30 inches (762 mm) on center.

10. Downspout supports: 20 gage, (0.0396 inch) (1.006 mm) straps at each joint and at center of section.

11. Back-paint concealed metal surfaces with bituminous coating to a minimum of 15 mils (0.38 mm) dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

B. Isolate dissimilar metals by means of a heavy bituminous coating, approved paint coating, adhered polyethylene sheet, or other means approved by the Sandia Delegated Representative (SDR).

3.03 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; Conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal work 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. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of one and one-half (1-1/2) inches (38.1 mm), except where

pretinned surface would show in finished work. Do not solder pre-painted, coil-coated, galvanized steel sheets.

D. Sealed Joints: Form non-expansion, but moveable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joints with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

2. Moving Joints: When ambient temperature is moderate (40 - 70 degrees F) (4 - 21 degrees C) at time of installation, set joined members for 50 percent movement either way. Adjust setting position of joined members proportionally for temperatures above 70 degrees F (21 degrees C). Do not install sealant at temperatures below 40 degrees F (4 degrees C). Refer to section on sealants, elsewhere in Division 7, for handling and installation requirements for joint sealers.

E. Counter-flashings: Coordinate installation of counter-flashings with installation of assemblies to be protected by counter-flashing. Install counter-flashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counter-flashing joints a minimum of two (2) inches (51 mm) and bed with sealant.

F. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

G. Roof Edge Flashings: Secure metal flashings at roof edges to comply with FM Loss Prevention Data Sheet 1-49 for Zone 2 wind exposure.

H. Surface-Mounted Reglets: Attach reglets securely to substrate, at locations indicated. Install elastomeric sealant at top edge.

3.04 CLEANING AND PROTECTION

A. Remove protective film from prefinished sheet metal immediately after installation.

B. Repair or replace work which is damaged or defective, as directed by SDR.

Refinish marred and abraded areas of prefinished sheet using finish manufacturer's recommended methods and materials. Replace units which cannot satisfactorily be refinished in place.

C. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

D. Provide final protection and maintain condition that ensures sheet metal flashing and trim work during construction is without damage or deterioration other than by natural weathering.

END OF SECTION

SECTION 07920
CAULKS AND SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior weatherproofing sealants.

B. Interior sealants.

C. Structural glazing sealants.

D. Glazing sealants.

1.2 REFERENCES

A. AAMA 802.3 - Specification for Ductile Back Bedding Glazing Compound.

B. AAMA 803.3 - Specification for Narrow Joint Seam Sealers.

C. AAMA 805.2 - Specification for Back Bedding Glazing Compound.

D. AAMA 808.3 - Specification for Exterior Perimeter Sealing Compound.

E. ASTM C 639 - Test Method for Rheological (Flow) Properties of Elastomeric Sealants.

F. ASTM C 717 - Terminology of Building Seals and Sealants.

G. ASTM C 719 - Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle).

H. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

I. ASTM C 920 - Specification for Elastomeric Joint Sealants.

J. ASTM C 1184 - Specification for Structural Silicone Sealants.

K. ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.

L. ASTM C 1382 - Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems (EIFS) Joints.

M. ASTM D 412 - Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

N. ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.

O. EIMA 300.01 - Determining Peel Adhesion and Tensile Adhesion Properties of Sealants Applied to EIFS Class PB.

P. Federal Specification TT-S-00227E - Sealing Compound, Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

Q. Federal Specification TT-S-00230C - Sealing Component, Elastomeric Type, Single Component (for Caulking, Sealing, & Glazing in Buildings and Other Structures).

R. Federal Specification TT-S-001543A - Sealing Compound: Silicone Rubber Base (For

Caulking, Sealing, and Glazing in Buildings and Other Structures).

S. Federal Specification TT-S-001543B - Sealing Compound: Silicone Rubber Base (For Caulking, Sealing, and Glazing in Buildings and Other Structures).

T. GANA - Sealant Manual and Related GANA Publications.

U. SWRI Sealant Manual and Related SWRI Publications.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods including joint design, surface preparation, and application instructions.
4. Submit manufacturer's test reports indicating test results of adhesion and/or compatibility testing of samples of substrates which either come in contact with or are in close proximity to sealants.
5. Submit manufacturer's shop drawings, indicating joint design, dimensions of lites, sealant contact width and depth dimensions, design wind loads and applicable information on gaskets, spacers, setting blocks and any other accessories.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Manufacturer's Certification: Submit manufacturer's certification that materials are suitable for intended application.

B. Installer Qualifications:

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Prepare mock-ups for sealants and for each type of surface using same materials, tools, equipment, and procedures intended for actual surface preparation and application under actual use and environmental conditions.
2. Verify adhesion of sealants and compatibility of material(s) in contact with or in close proximity to sealants.
3. Observe for sealant and surface staining or discoloration.
4. Obtain Architect's approval of mock-ups.
5. Retain mock-ups to establish intended standards by which sealants will be judged.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
1. Product name.
2. Manufacturer.
3. Sealant color.
4. Sealant batch or lot number.

5. Sealant use-before date.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
1. Store materials in a clean, dry area indoors in accordance with manufacturer's instructions.
2. Store sealants within temperature range in accordance with manufacturer's instructions.
3. Keep containers sealed until ready for use.
4. Do not use materials after manufacturer's use-before date.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
1. Do not apply sealants to surfaces that are wet, damp, or contain frost.
2. Do not apply sealants when air or surface temperature is below 40 degrees F (7 degrees C).
3. Use caution when applying sealants when air or surface temperature is above 120 degrees F (49 degrees C).

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric 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 elastomeric sealant manufacturer agrees to furnish elastomeric 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: Ten years from date of Substantial Completion.

C. Special warranties specified exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Specification is based on products as manufactured by Momentive Performance Materials - GE Exclusive Licensee, which is located at: 9930 Kincey Ave. ; Huntersville, NC 28078; Toll Free Tel: 877-943-7325; Email: carl.ward@momentive.com; Web: www.ge.com/silicones.

B. Requests for substitutions will be considered in accordance with provisions of Division

1.

2.2 WEATHERPROOFING SILICONE SEALANTS AND ADHESIVES

A. One-component, medium-modulus, neutral-cure, non-stain, non-bleed, 100 percent silicone polymer sealant.
   1. Acceptable Product: SilPruf NB SCS9000 Silicone Sealant as manufactured by Momentive Performance Materials - GE Exclusive Licensee.
   2. Compliance:
      a. ASTM C 920, Type S, Grade NS, Class 50.
      b. Federal Specification TT-S-001 543B.
      c. Federal Specification TT-S-00230C.
   3. Properties: After 21 days at 70 degrees F and 50 percent relative humidity.
      a. Dynamic Movement Capability, ASTM C 719: +/- 50 percent.
   4. Application: Field apply.
   5. Color: Contact manufacturer for color selection.

B. One-component, low-modulus, neutral-cure, 100 percent silicone polymer sealant.
   1. Acceptable Product: SilPruf LM SCS2700 Silicone Sealant as manufactured by Momentive Performance Materials - GE Exclusive Licensee.
   2. Compliance:
      a. ASTM C 920, Type S, Grade NS, Class 100/50.
      b. Federal Specification TT-S-001 543B.
      c. Federal Specification TT-S-00230C.
   3. Properties: After 21 days at 75 degrees F and 50 percent relative humidity.
      a. Dynamic Movement Capability, ASTM C 719: +100/-50 percent.
   4. Application: Field apply.
   5. Color: Contact manufacturer for color selection.

C. One-component, medium-modulus, high strength, neutral-cure, 100 percent silicone polymer sealant.
   1. Acceptable Product: SilPruf SCS2000 Silicone Sealant as manufactured by Momentive Performance Materials - GE Exclusive Licensee.
   2. Compliance:
      a. ASTM C 920, Type S, Grade NS, Class 50.
      b. Federal Specification TT-S-001 543B.
      c. Federal Specification TT-S-00230C.
      d. ASTM C 1184.
   3. Properties: After 21 days at 75 degrees F and 50 percent relative humidity.
      a. Dynamic Movement Capability, ASTM C 719: +/-50 percent.
   4. Application: Field apply.
   5. Color: Contact manufacturer for color selection.

D. Pre-cured Silicone Weatherstrip.
   1. Acceptable Product: UltraSpan US1100 Pre-cured Silicone Weatherstrip as manufactured by Momentive Performance Materials - GE Exclusive Licensee.
   2. Properties: Cured rubber extrusion properties.
      a. Hardness, Shore A (ASTM D2240): 30.
      b. Tensile Strength, psi (ASTM D412): 700.
      c. Elongation, % (ASTM D412): 400.
      d. Tear Strength, die B (ASTM D624): 70.
   3. Application: Field apply.
   4. Color: Contact manufacturer for color selection.

2.3 INTERIOR SEALANTS

A. One part, paintable acrylic polymer sealant.
   1. Acceptable Product: RCS20 Siliconized Acrylic Sealant as manufactured by Momentive Performance Materials - GE Exclusive Licensee.
   2. Compliance:
      a. ASTM C 834, Type C and OP.
      b. ASTM E90 and C919, 43 STC and 32 OITC.
   3. Application: Field apply.
   4. Color: Contact manufacturer for color selection.

2.4 STRUCTURAL GLAZING ADHESIVES/SEALANTS

A. One-component, high-modulus, high-strength, neutral-cure, 100 percent silicone polymer sealant. Accelerated cure structural glazing adhesive/sealant.
   1. Acceptable product: UltraGlaze SSG4000AC (accelerated cure) Silicone Structural Glazing Adhesive/Sealant as manufactured by Momentive Performance Materials - GE Exclusive Licensee.
   2. Compliance:
      a. ASTM C 1184, Type S, Use G and O.
      b. ASTM C 920, Type S, Grade NS, Class 25, Use NT, A, G, O.
      c. Federal Specification TT-S-001543A.
      d. Federal Specification TT-S-00230C.
   3. Dynamic Movement Capability, SATM C 719: +/- 25 percent.
   4. Application: Factory and/or Field apply as indicated on the drawings.
   5. Color: Contact manufacturer for color selection.

2.5 GENERAL GLAZING SEALANTS

A. One-component, neutral-cure, medium-modulus, fast cure, fast green strength, 100 percent silicone polymer sealant.
   1. Application: Factory and/or Field apply as indicated on the drawings.
   2. Color: Blue White.

2.6 ACCESSORIES

A. Primer: Momentive Performance Materials - GE Exclusive Licensee SS4179, SS4044P, SS4004P (tinted) or SCP3195P primer(s) as recommended by manufacturer and required by application.

B. Backer Rod for Weather Sealing Applications:
   1. Material: Non-gassing polyethylene or flexible polyurethane foam rod.
   2. EIFS and Porous Surface Applications: Non-gassing polyethylene, non-gassing polyolefin or flexible polyurethane foam rod.
   3. Width: 25 to 50 percent greater than width of joint to extend continuous pressure against joint walls.
   4. Material shall expand and contract with bead movement without pushing sealant out of joint during compression cycle.
   5. Do not use solid rubber backup materials, unless tested for compatibility with sealants and approved by Architect.

C. Bond Breaker Tape: Polyethylene tape, approved by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints to receive sealants. Notify Architect if conditions are not acceptable.

B. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

A. Prepare joints in accordance with manufacturer's instructions.

B. Ensure joint thickness is as indicated on the drawings.

C. Remove dirt, dust, oil, grease, rust, loose materials, contaminants, and existing sealants from surfaces that contact sealants.

D. Clean surfaces within 1 to 2 hours before applying sealants.

3.3 APPLICATION - STRUCTURAL GLAZING ADHESIVES/SEALANTS

A. Apply sealants in accordance with manufacturer's instructions at locations indicated on the drawings.

B. All materials to receive structural adhesive/sealant shall be tested and approved by Momentive Performance Materials - GE Exclusive Licensee Sealants & Adhesives on a project-by-project basis.

C. Ensure surfaces to receive sealants are clean, sound, dry, and free of frost.

D. Use manufacturer's approved back-up materials, spacers, and setting blocks to ensure sealant compatibility and function.

E. Priming:
1. Apply primer, if required, in accordance with manufacturer's instructions.
2. Perform trial applications to check adhesion of sealants to specific materials to be used.
3. Do not apply primer to glass surfaces.
4. Allow primer to dry before applying sealant.

F. Masking:
1. Mask exterior face of joint where necessary with pressure-sensitive tape before applying sealant. Start from top down and overlap runs.
2. Do not allow tape to touch clean surfaces to which sealants are to adhere.
3. Remove tape immediately after tooling and before sealants begin to cure.

G. Protection: Cover all surfaces likely to receive excess sealant removed during tooling operations.

H. Ensure contact width of sealant between glass and metal frame is as indicated on the drawings.

I. Install backup material or joint filler, setting blocks, spacer shims, and tapes as required.

J. Apply sealants in a uniform continuous operation, horizontally in 1 direction and vertically from bottom to top of joint opening. Apply positive pressure adequate to properly fill and seal joint. Air pockets or voids are not acceptable.

K. Immediately tool joint neatly, forcing sealant into contact with sides of joint to eliminate internal voids and to assure good substrate contact. Do not tool with soap or detergent solutions.

L. Tool sealants at sill in glazing so precipitation and cleaning solutions will not pool.

3.4 **WEATHER SEALING APPLICATION**

A. Apply sealants in accordance with manufacturer's instructions at locations indicated on the drawings.

B. Ensure surfaces to receive sealants are clean, sound, dry, and free of frost.

C. Use manufacturers approved primer, backer rod, and bond breaker tape.

D. Priming:
1. Apply primer, if required, in accordance with manufacturer's instructions.
2. Perform trial applications to check adhesion of sealants to specific materials to be used.
3. Do not apply primer to glass surfaces.
4. Allow primer to dry before applying sealant.

E. Masking:
1. Apply masking tape to surfaces as required to ensure a neat application of sealants and to protect adjoining surfaces.
2. Do not allow masking tape to touch clean surfaces to which sealants are to adhere.
3. Remove masking tape immediately after tooling and before sealants begin to cure.

F. Install backer rod in joint to allow for appropriate depth of sealants and to prevent 3-sided adhesion.

G. Install backer rod in joint to allow for appropriate depth of sealants and to prevent 3-sided adhesion.

H. Install bond breaker tape when joint depth is too shallow to allow backer rod.

I. Apply sealant depth of 1/8 inch minimum to 3/8 inch maximum over crown of backer rod.

J. Apply sealants in a continuous operation, horizontally in 1 direction and vertically from bottom to top of joint opening. Apply positive pressure adequate to properly fill and seal joint width.

K. Tool or strike sealants with appropriate tool applying light pressure to spread sealants against back-up material and joint surfaces to ensure void-free application. Do not use soap or detergent solutions for tooling.

L. Tool sealants at sill in glazing so precipitation and cleaning solutions will not pool.

3.5 CLEANING

A. Remove excess sealants from glass, metal, and plastic surfaces while still uncured.

B. Remove excess sealants from porous surfaces after initial cure or set-up.

3.6 PROTECTION

A. Protect sealants in joints from damage until fully cured.

END OF SECTION

SECTION 08110
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel doors.

B. Steel frames.

C. Steel sidelights and borrowed lights.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete; Placement of anchors in concrete construction.

B. Section 04810 - Unit Masonry Assemblies; Placement of anchors in masonry construction.

C. Section 08210 - Wood Doors.

D. Section 08710 - Door Hardware.

E. Section 08800 - Glazing

F. Section 09900 - Paints and Coatings.

1.3 REFERENCES

A. ASTM A568 - Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.

B. ASTM A591 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hop-Dip Process

C. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

E. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

F. ASTM A1011 - Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

G. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames.

H. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.

I. ANSI/SDI A250.6 Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

J. ANSI/SDI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 1998.

K. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

L. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames (Formerly SDI-105).

M. DHI A115.1G - Installation Guide for Doors and Hardware.

N. SDI 111 - Recommended Standard Details for Steel Doors & Frames.

O. ANSI/NFPA 252 - Fire Tests of Door Assemblies.

P. ANSI/UL 10B - Fire Tests of Door Assemblies.

Q. ANSI/UL 10C - Positive Pressure Fire Tests of Door Assemblies.

R. ANSI/UL 1784 - Air Leakage Tests of Door Assemblies

S. UL - Building Materials Directory; Underwriters Laboratories Inc.

T. WH - Certification Listings; Warnock Hersey International Inc.

U. NFPA 80 - Fire Doors and Fire Windows.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. [Product Data]: Submit manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Certificates:
1. Provide manufacturer's certification that products comply with referenced standards as applicable.
2. Provide evidence of manufacturer's membership in the Steel Door Institute.

D. Shop Drawings:
1. Show all openings in the door schedule and/or the Drawings.
2. Provide details of door design, door construction details and methods of assembling sections, hardware locations, anchorage and fastening methods, door frame types and details, anchor types and spacing, and finish requirements.
3. Provide door, frame, and hardware schedule in accordance with SDI 111.

E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and finishes.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all products from a single manufacturer who is a member of the Steel Door Institute.

B. Doors and frames shall conform to the requirements of ANSI A250.8-1998 (SDI-100) and other specifications herein named.

C. Fire Rated Doors and Frames: Ratings as indicated on Door Schedule, when tested in accordance with NFPA 252, UL 10B or UL 10C.
   1. Labeled by UL, WH, or other agency acceptable to the authorities having jurisdiction.
   2. Stairwell Doors: 250 degrees F (121 degrees C) or 450 degrees F (232 degrees C) temperature rise rating as well as the required fire rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Products shall be marked with Architect's opening number on all doors, frames, misc. parts and cartons.

B. Upon delivery, inspect all materials for damage; notify shipper and supplier if damage is found.

C. Protect products from moisture, construction traffic, and damage.
   1. Store vertically under cover.
   2. Place units on 4 inch (102 mm) high wood sills or in a manner that will prevent rust or damage.
   3. Do not use non-vented plastic or canvas shelters.
   4. Should wrappers become wet, remove immediately.
   5. Provide 1/4 inch (6 mm) space between doors to promote air circulation.

1.7 COORDINATION

A. Coordinate with door opening construction and door frame and door hardware installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Products shall be manufactured by a member of the Steel Door Institute, 30200 Detroit Road, Cleveland, Ohio 44145. ASD. Tel: (440) 899-0010, Fax: (440) 892-1404. Steel Door Institute Members are as follows:
   1. Amweld Building Products, LLC.
   2. Ceco Door Products.
   3. Curries Company.
   4. Deansteel Manufacturing Co.
   5. Mesker Door, Inc.
   6. Pioneer Industries, Inc.
   7. Republic.
   8. Security Metal Products Corp.
   9. Steelcraft.

B. Substitutions: Not permitted.

2.2 MATERIALS

A. Doors, frames, frame anchors, and hardware reinforcings for each of the levels and models specified shall be provided to meet the requirements of the performance levels specified. The material used in

manufacturing these products and components shall comply with ANSI/SDI A250.8. Hardware reinforcing on doors and frames shall comply with ANSI/SDI A250.6. The physical performance levels shall be in accordance with ANSI/SDI A250.4.

B. All steels used to manufacture doors, frames, anchors, and accessories shall meet at least one or more of the following requirements:
   1. Cold rolled steel shall conform to ASTM A1008 and A568.
   2. Hot rolled, pickled and oiled steel shall comply with ASTM A1011 and A568.
   3. Hot dipped zinc coated steel shall be of the alloyed type and comply with ASTM A924 and A653.
   4. Steel Sheet, Electrolytic Zinc-Coated shall conform to ASTM A591.

2.3 FRAMES

A. Provide Levels and Models in accordance with ANSI/SDI A250.8 as indicated in the door schedule.

B. Interior frames: Frame configuration and depth as indicated. Minimum thickness as follows:
   1. Level 2 Heavy duty: For use with:
      a. Door Model 1 (full flush design): 0.053 inch (1.3 mm) minimum steel frame thickness.

C. Exterior frames: Provide in accordance with ANSI/SDI A250.8 in the frame configuration and depth as indicated on the Drawings. Minimum thickness as follows:
   1. Level 2 Heavy duty: For use with:
      a. Door Model 1 (full flush design): 0.053 inch (1.3 mm) minimum steel frame thickness.

D. Provide units of galvanized steel in the following locations:
   1. Exterior openings.
   2. Toilets.
   3. Washrooms.
   4. Locker rooms.

E. Provide knockdown field assembled type frames unless otherwise indicated.

F. Provide face welded type frames unless otherwise indicated.

G. Provide frames, other than slip-on drywall type with a minimum of three anchors per jamb suitable for the adjoining wall construction. Provide anchors of not less than 0.042 inch (1.0 mm) in thickness or 0.167 inch (4.2 mm) diameter wire. Frames over 7 feet 6 inches (2286 mm) shall be provided with an additional anchor per jamb.

H. Slip-on drywall frame anchors shall be as provided by the manufacturer to assure performance specified.

I. Base anchors shall be provided, other than slip-on drywall type, with minimum thickness of 0.042 inch (1.0mm). For existing masonry wall conditions that do not allow for the use of a floor anchor, an additional jamb anchor shall be provided.

J. Prepare all frames for all mortise template hardware and reinforced only for surface mounted hardware. Drilling and/or tapping shall be completed by others.

K. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.

L. Provide glazing stops and beads where glazed lights are indicated.

2.4 DOORS

A. Interior doors: Provide interior doors in accordance with ANSI/SDI A250.8 and in the configuration and sizes as indicated on the door schedule:
   1. Level 2 - Heavy duty 1-3/4 inches (44.5 mm):
      a. Model 1 - Full flush

B. Exterior doors: Provide exterior doors in accordance with ANSI/SDI A250.8 and in the configuration and size as indicated on the door schedule:

   1. Level 2 - Heavy duty 1-3/4 inches (44.5 mm):
      a. Model 1 - Full flush

C. Face steel sheet shall meet at least one or more of the following requirements:
   1. Level 2
      a. Model 1 - 0.042 inch (1.0 mm) minimum thickness

D. End closure: The top and bottom of the doors shall be closed with channels or closures. The channels or closures shall have a minimum material thickness of 0.042 inch (1.0 mm).
   1. Flush closure channels: Set back face of channel web flush with door top/bottom.

E. Core: Provide in accordance with ANSI/SDI A250.8.

F. Door edge design: Provide in accordance with ANSI/SDI A250.8.

G. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.

H. Provide louvers and vision lites where indicated on the Drawings in accordance with ANSI/SDI A250.8.

I. Provide steel astragals where indicated on the Drawings or where required by the manufacturer or NFPA 80.

2.5 FABRICATION

A. Fabricate doors and frames in accordance with ANSI/SDI A250.8.

B. Prime finish: Doors and frames shall be thoroughly cleaned, and chemically treated to insure maximum paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

C. Factory applied finish: Meet the performance requirements and acceptance criteria as stated in ANSI/SDI A250.3. Color shall be:
   1. As selected from the manufacturers standard colors.

D. Design clearances: Fabricate doors and frames to maintain the following clearances:
   1. The clearance between the door and frame shall be 1/8 inch (3.2 mm) in the case of both single swing and pairs of doors.
   2. The clearance between the meeting edges of pairs of doors shall be 3/16 inch (4.8 mm) plus or minus 1/16 inch (1.6 mm). For fire rated applications, the clearances between the meeting edges of pairs of doors shall be 1/8 inch (3.2 mm) plus or minus 1/16 inch (1.6 mm).
   3. The clearance measured from the bottom of the door to the bottom of the frame (undercut)

shall be a maximum of 3/4 inch (19.1 mm) unless otherwise specified. Fire door undercuts shall comply with ANSI/NFPA 80, "Fire Doors and Fire Windows."

4. The clearance between the face of the door and the stop shall be 1/16 inch (1.6 mm) to 3/32 inch (2.4 mm).
5. All clearances shall be, unless otherwise specified in this document, subject to a tolerance of plus or minus 1/32 inch (0.8 mm).
6. The clearance at the bottom shall be 3/4 inch (19.1 mm).
7. The clearance between the face of the door and doorstop shall be 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm).
8. All clearances shall be, unless otherwise specified, subject to a tolerance of plus or minus 1/32 inch (0.8 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are suitable before beginning installation of frames. Do not begin installation until conditions have been properly prepared.
   1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
   2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
   3. Verify that drywall construction walls are the correct thickness.

B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install frames plumb, level, rigid, and in true alignment in accordance with ANSI A250.11 and DHI A115.1G.

B. Install fire rated doors and frames in accordance with NFPA 80.

C. All frames other than slip-on types shall be fastened to the adjacent structure so as to retain their position and stability. Drywall slip-on frames shall be installed in prepared wall openings in accordance with manufacturer's instructions.

D. Install frames as masonry is laid-up. Fill welded wrap-around frames in masonry construction solid with grout. Brace or fasten frame in such a way to prevent pressure of the grout from deforming frame. Coordinate with work specified in Section 04810.

E. Install frames in stucco construction as work progresses. Fill welded wrap-around frames solid with grout where indicated. Brace or fasten frame in such a way to prevent pressure of the grout from deforming frame. Coordinate with work specified in Section 09220.

F. Grout shall be mixed to provide a 4 inch (102 mm) maximum slump consistency, hand troweled into place. Grout mixed to a thin "pumpable" consistency shall not be used.

G. If additives are used in masonry or plaster work during cold weather, field coat the inside of steel frames with a bituminous compound to prevent corrosion.

H. Doors shall be installed and fastened to maintain alignment with frames to achieve maximum operational effectiveness and appearance. Doors shall be adjusted to maintain perimeter clearances

specified. Shimming shall be performed by the installer as needed to assure the proper clearances are achieved.

3.3 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces. Remove scraps and debris and leave site in a clean condition.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 SCHEDULE

A. Refer to Door and Frame Schedule appended to this section.

END OF SECTION

SECTION 08360
SECTIONAL OVERHEAD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulated Sectional Overhead Doors.

B. Steel Sectional Overhead Doors.

C. Glazed Aluminum Sectional Overhead Doors.

D. Electric Operators and Controls.

E. Operating Hardware, tracks, and support.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 04 22 00 - Surface-Bonded Concrete Unit Masonry.

C. Section 05 50 00 - Metal Fabrications.

D. Section 06 11 00 - Wood Framing.

E. Section 07 90 00 - Joint Protection.

F. Section 08 71 53 - Security Door Hardware.

G. Section 09 90 00 - Painting and Coating.

H. Section 11 12 26 - Parking Fee Coin Collection Equipment.

I. Section 26 27 16 - Electrical Cabinets and Enclosures.

J. Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Wiring Connections: Requirements for electrical characteristics.
   1. 115 volts, single phase, 60 Hz.
   2. 230 volts, single phase, 60 Hz.
   3. 230 volts, three phase, 60 Hz.
   4. 460 volts, three phase, 60 Hz.

B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened labeled packaging until ready for installation.

B. Protect materials from exposure to moisture until ready for installation.

C. Store materials in a dry, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.9 WARRANTY

A. Warranty: Manufacturer's limited door and operators System warranty for 10 year against delamination of polyurethane foam from steel face and all other components for 3 years or 20,000 cycles, whichever comes first.

B. Warranty: Manufacturer's limited door and operators System warranty for 8 year against delamination of polyurethane foam from steel face and all other components for 3 years or 20,000 cycles, whichever comes first.

C. Warranty: Manufacturer's limited door and operators System warranty for 10 years against delamination of polystyrene foam from steel face.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 929-3667. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: arcat@overheaddoor.com.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 INSULATED SECTIONAL OVERHEAD DOORS

A. Insulated Steel Sectional Overhead Doors: 422 Series Insulated Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:
   1. Door Assembly: Insulated steel door assembly with rabbeted meeting rails to provide full-width interlocking structural rigidity.
      a. Panel Thickness: 2 inches (51 mm).
      b. Exterior Surface: Ribbed.
      c. Exterior Steel: 20 gauge, hot-dip galvanized.
      d. Back Cover
         1) High Impact Polystyrene Backcover.
      e. Center and End Stiles: 16 gauge steel.
      f. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor.
         1) High cycle spring: 100,000 cycles.
      g. Insulation: Polystyrene.
      h. Thermal Values:
         1) Polystyrene - R-value of 7.35; U-value of 0.136.
      i. Partial Glazing of Steel Panels:
         1) Insulated double strength glass, 24 inch by 7 inch (610 mm by 178 mm) window.
         2) Insulated tempered glass, 24 inch by 7 inch (610 mm by 178 mm) window.
      j. Full Glazed Aluminum Sash Panels:
         1) 1/2 inch (12.5 mm) Insulating Glass.
   2. Finish and Color: Two coat baked-on polyester with white exterior and white interior color.
   3. Wind Load Design: Use the applicable building code to determine the actual loading required and edit the following paragraph accordingly. Coordinate with the manufacturer for the selection of doors to meet the required criteria.
      a. Design pressure of 90 lb/sq ft.
   4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
   5. Lock:
      a. Interior mounted slide lock with interlock switch for automatic operator.
   6. Weatherstripping:
      a. Flexible bulb-type strip at bottom section.
      b. Flexible Jamb seals.
      c. Flexible Header seal.

7. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
   a. Size:
      1) 3 inch (76 mm).
   b. Type:
      1) Vertical lift.
      2) High lift.
      3) Follow roof slope.
8. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
   a. Entrapment Protection: Required for momentary contact, includes radio control operation
      1) Photoelectric sensors monitored to meet UL 325/2010.
   b. Operator Controls:
      1) Push-button operated control stations with open, close, and stop buttons.
      2) Surface mounting.
      3) Interior location.
   c. Special Operation:
      1) Pull switch.
      2) Vehicle detector operation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until openings have been properly prepared.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean adjacent surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural

members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 CLEANING AND ADJUSTING

A. Adjust door assembly to smooth operation and in full contact with weatherstripping.

B. Clean doors, frames, glass and polycarbonate according to manufacturer's instructions.

C. Remove temporary labels and visible markings. Do not remove polycarbonate care and maintenance label required to maintain warranty.

3.5 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of project.

C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 08700
FINISH HARDWARE

1.01 GENERAL:

Work under these specifications shall conform to Contract Documents for the General Construction of the Building.

1.02 ITEMS NOT INCLUDED:

This Section does not cover items generally known as rough hardware, nor items of Finish Hardware, when noted elsewhere in the Specifications as being furnished, or included with unit' items, by other suppliers or contractors, including hardware for casework, aluminum exterior doors or security doors.

2.01 MATERIALS AND INSTALLATION INFORMATION:

A. See Door, Frame and Hardware Schedule on drawings for location and type of hardware for each door.

B. Approved hardware shall be as follows:

1. Hinges: Exterior doors, Hager BB 1199, 4-1/2 x 4-1/2 x US26D, Interior doors, Hager BB 1279, 4-1/2 x 4-1/2 US26D
2. Closers: Norton 7500 Series.
3. Panic Device: Sargent 80 Series, US26D.
4. Locksets: Corbin-Russwin, US26D.
5. Cylinders: Corbin-Russwin, Mortise Cylinders or Rim Cylinders
6. Accessories: (Push-Pull, Kick Plates, Weather-strip, Threshold, Stops, etc.) Brookline Industries, Stanley Hardware, National Guard Products, Triangle Brass or Trimco.

C. All hardware, mounting and location to conform to Kentucky Building Code and shall be approved by the Architect.

2.02 HARDWARE FINISH:

All hardware specified herein shall be US26D unless noted otherwise.

3.01 MOUNTING:

All hardware shall be firmly and rigidly attached to the doors and frames. Door closers, specified to be surface mounted, shall be thru-bolted to the door with oval head sex bolts. All door pulls and other surface mounted items shall be thru-bolted to the door with oval head sex bolts, except push and kick-plates. Out-swinging doors shall have hinges with non-removable pins.

3.02 APPLICATION:

A. Finish hardware shall be installed under the Carpentry Section 06200, using mechanics skilled in this type of work. Installation shall be in a neat, workmanship manner, in accordance with the approved hardware and door schedule.

B. All items of hardware shall be secure and free working in manner intended. Hardware shall be accurately mortised and fitted before painting. Hardware shall not be applied until the painting is finished.

C. After the hardware is installed, the General Contractor shall cover all exposed surfaces of kickplates, push plates, pulls, locksets, exit devices, holders, etc., with a suitable covering, such as masking tape and polyethylene film, to protect the hardware from scratches, abrasion, and tarnishing. This is to be left on until the building is completed and ready for final inspection.

D. Upon completion of application, the Contractor shall deliver to the Architect, for the Owner's maintenance personnel, two (2) copies of all installation instructions, templates, wrenches, installation tools, etc., supplied by the various manufacturers and packed with the hardware, necessary for installation and maintenance.

3.03 KEYING:

Each lock shall have four (4) change keys and locks shall be keyed alike as directed. All locks shall be subject to Master Key per the Owner's direction. Deliver to the Architect six (6) Master Keys per Master Key group. No master key shall be delivered to any other person.

3.04 SELECTIONS AND ORDERING:

A. The Architect shall be provided with Shop Drawings for approval. Approved Shop Drawings shall then authorize and direct General Contractor to place his written order for such hardware. Upon receipt of written order, hardware supplier will furnish the necessary copies of detailed schedules to all parties concerned within ten (10) days. He will furnish all necessary blueprints, templates and such other detailed information, relative to the installation of this hardware.

B. In preparing his bid or schedule, the hardware supplier shall check the suitability and adaptability of all items specified in relation to all details and surrounding conditions. The Architect's attention shall be called to any items not suitable or adaptable, and to any manifest errors, typographical or otherwise, so that corrections may be made before any hardware is furnished.

3.05 DISCREPANCIES:

Shortages and/or incorrect items (based on Plans and Specifications in effect at the time of the selection of the Builder's Finishing Hardware) shall be replaced with correct materials by the Hardware Distributor, at no additional cost to the General Contractor or Owner.

The General Contractor shall provide adequate locked storage space with shelving and be responsible for the schedule quantities of hardware when delivered to the job, and for the payment of invoices covering such material, when and as delivered.

END

SECTION 09960

COATINGS – WATER PLANT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the finishes as indicated on drawings and schedules, and as herein specified.

B. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

C. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated. In addition, the Contractor shall provide for the use of deep tone colors to be applied in selected areas as wall graphics, stripes and visual accents. The areas and colors shall be selected by the Architect-Engineer and shall not exceed 15% of the total wall surface area to be painted.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect-Engineer will select these from standard colors or finishes available.

F. Following categories of work are not included as part of field- applied finish work.

1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, and finish mechanical and electrical equipment, including light fixtures, switchgear, and distribution cabinets.

2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, pipe spaces, and duct shafts.

3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.

4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

G. Following categories of work are included under other sections of these specifications.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is

included under various sections for structural steel, metal fabrications, hollow metal work and similar items.

2. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these Specifications.

H. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

I. PVC plastic process piping shall not be painted, but shall be stenciled and labeled or tagged for identification surfaces. Each type of process piping using PVC pipe shall be installed using the same color pipe.

J. Repainting of existing structures, tanks, piping, and all other existing items shall not be part of this Contract unless otherwise noted. Areas that have been directly altered or damaged by construction shall be repainted to match existing conditions using the appropriate painting system.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to Work of this Section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.

B. Samples: Prior to beginning work, submit color chips for surfaces to be painted. Use representative colors when preparing samples for review. Submit samples for Architect-Engineer's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work: Review other sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coatings systems for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.05 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.

2. Fed. Spec. number, if applicable.

3. Manufacturer's stock number, batch number, and date of manufacturer.

4. Manufacturer's name.

5. Contents by volume, for major pigment and vehicle constituents.

6. Thinning instructions.

7. Application instructions.

8. Color name and number.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.06 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted or restricted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. Paint only when the surface temperature is at least 5 degrees F above the dew point, unless otherwise permitted by paint manufacturer’s printed instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Tnemec Company, Inc. (Tnemec)

2. The Sherwin-Williams Company

3. Engineer Approved Equal

2.02 MATERIALS

A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

1. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.

PART 3 - EXECUTION

3.01 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect-Architect-Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.

2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning per SSPC SP-1. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

4. Abrasives for blasting shall be sharp, washed, salt free, angular, and free from feldspar or other constituents that tend to breakdown and remain on the surface.

5. Concrete floors shall be dry as indicated by testing in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

B. Cementitious Materials: Per ASTM D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating, prepare cementitious surfaces of concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Per ASTM D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces, determine alkalinity of surfaces to be painted by performing

appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Test the surface for moisture and do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

C. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.

2. When transparent finish is required, use spar varnish for backpriming.

D. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, and other foreign substances by solvent cleaning per SSPC SP-1. Mechanical cleaning shall be in accordance with SSPC-SP6 Commercial Blast Cleaning specifications for non-immersion surfaces and SSPC-SP10 Near White Metal Blast Cleaning for immersion in potable or non-potable water.

E. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent. For immersion service, clean in accordance with SSPC-SP16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.

F. Shop Primed Surfaces: Prepare shop-applied prime coats wherever damaged or bare as required by other sections of these Specifications. Clean and touch-up with same type shop primer.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Painting requirements, surface treatments, and finishes, are indicated in "schedules" of the contract documents and as noted in Paragraph 3.11 hereinafter.

2. Provide finish coats which are compatible with prime paints used.

3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds,

and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently- fixed equipment or furniture with prime coat only before final installation of equipment.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

7. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

8. Sand lightly between each succeeding enamel or varnish coat.

9. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.

1. Mechanical items to be painted include, but are not limited to, the following:

a. Piping, pipe hangers, supplementary steel and supports except galvanized surfaces.

b. Heat exchangers.

c. Tanks.

d. Ductwork, insulation.

e. Motor, mechanical equipment, and supports.

f. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:

a. Conduits and fittings except galvanized surfaces.

b. Switchgear (touch up only).

c. Hanger and support except galvanized surfaces.

E. Prime Coats: Apply prime coat of material which is required to be painted or finished, and

which has not been prime coated by others. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn- through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable. Holiday test coated steel in immersion areas in accordance with NACE International SP0188-2007 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

G. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.05 FIELD QUALITY CONTROL

A. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:

1. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

2. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

B. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.06 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect-Architect-Engineer. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 PAINTING SYSTEMS

A. Ferrous Metals, Structural, Tanks, Pipe and Equipment

1. Exterior, Non-Immersion

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning	
1st Coat	91H20	2.5 – 3.5	Corothane I Galvapac NSF	2.5 – 3.5
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0
3rd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS	2.0 – 3.0

2. Interior, Non-Immersion

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning	
1st Coat	91H20	2.5 – 3.5	Corothane I Galvapac NSF	2.5 – 3.5
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0
3rd Coat	N69 High-Build Epoxoline	2.0 – 3.0	Macropoxy 646	2.0 – 3.0

3. Immersion, Potable or Non-Potable Water

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP10 Near-White Blast Cleaning		SSPC-SP10 Near-White Blast Cleaning	
1st Coat	N140	4.0 – 6.0	Macropoxy 646 PW	4.0 – 6.0
2nd Coat	N140	4.0 – 6.0	Macropoxy 646 PW	4.0 – 6.0
3rd Coat	N140	4.0 – 6.0	Macropoxy 646 PW	4.0 – 6.0

4. Factory Primed Interior (Refer to Piping Specifications)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Touch up	N69 High-Build Epoxoline		Macropoxy 646	
1st Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0
2nd Coat	N69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0

5. Factory Primed, Exterior (Refer to Piping Specifications)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Touch up	N69 Hi-Build Epoxoline		Macropoxy 646	
1st Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0
2nd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS, B65 Series	2.0 – 3.0

6. Primed Steel (Doors, Frames, etc.) - Exterior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Touch-up	N69 High-Build Epoxoline		Macropoxy 646	
1st Coat	N 69 High-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0
2nd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS	2.0 – 3.0

7. Buried

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP6 Commercial Blast Cleaning		SSPC-SP6 Commercial Blast Cleaning	
1st Coat	Hi-Build Tneme-Tar	16.0 – 20.0	Hi-Mil Sher-Tar Epoxy	16.0 – 24.0

B. Galvanized Steel - Pipe and Miscellaneous Fabrications

1. Exterior, Non-Immersion

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP1 Solvent Cleaning		SSPC-SP1 Solvent Cleaning	
1st Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0
2nd Coat	1074 Endura -Shield	2.0 – 3.0	Acrolon 218 HS	2.0 – 3.0

2. Interior, Non-Immersion (Doors, Frames, etc.)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP1 Solvent Cleaning		SSPC-SP1 Solvent Cleaning	
1st Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0
2nd Coat	N69 Hi-Build Epoxoline	4.0 – 6.0	Macropoxy 646	2.0 – 3.0

3. Immersion, Potable or Non-Potable Water

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP16 Brush-Off Blast Cleaning		SSPC-SP16 Brush-Off Blast Cleaning	
1st Coat	20-1255 Potapox	4.0 – 6.0	Macropoxy 646 NSF	4.0 – 6.0
2nd Coat	20-11 WH Potapox	4.0 – 6.0	Macropoxy 646 NSF	4.0 – 6.0

C. Porous Masonry - Concrete Masonry Units

1. Interior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	130 Envirofill (Spray and Back Roll to Fill Porosity)	80 - 100 sf/gal.	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	80-100 sf/gal
2nd Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0– 3.0
3rd Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0– 3.0

2. Exterior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	Series 156 Enviro-Crete	6.0 – 8.0*	Loxon XP	6.0-8.0*
2nd Coat	Series 156 Enviro-Crete	6.0 – 8.0*	Loxon XP	6.0-8.0*

*Coats must be sufficient to fill the porosity of the block face and create a pinhole-free surface.

D. Cast-In-Place Concrete

1. Concrete Walls & Precast Concrete Ceilings (Interior)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP13 Abrasive Blast		SSPC-SP13 Abrasive Blast	
1st Coat	113 H.B. Tneme Tuf-coat	4.0–6.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	4.0 – 6.0
2nd Coat	113 H.B. Tneme Tuf-coat	4.0–6.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	4.0 – 6.0

2. Concrete Walls, Exterior & Non-Potable

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	Series 156 Enviro-Crete	125 sf/gal	Loxon Masonry Primer	125 sf/gal
2nd Coat	Series 156 Enviro-Crete	200 sf/gal	Loxon Masonry Coating	200 sf/gal

3. Floors (Where noted on the drawings or specified)

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast	
1st Coat	N 66 Epoxoline	3.0 – 5.0	Macropoxy 646	3.0 – 5.0
2nd Coat	N 66 Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0
3rd Coat	N 66 Epoxoline	4.0 – 6.0	Macropoxy 646	4.0 – 6.0

4. Concrete Tanks & Basins

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast	
1st Coat	N140	4.0 – 6.0	Macropoxy 646 PW	4.0 – 6.0
2nd Coat	N140	4.0 – 6.0	Macropoxy 646PW	4.0 – 6.0
3rd Coat	N140	4.0 – 6.0	Macropoxy 646PW	4.0 – 6.0

5a. Chemical Containment Areas – Acid Exposure

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast	
1st Coat	Series 120-5002 Vinyl Ester	12 – 18	CoroBond Vinyl Ester Primer	3.5 – 4.0
2nd Coat	Series 120-5002 Vinyl Ester	12 - 18	CorCote VEN FF	15.0 – 20.0
3rd Coat			CorCote VEN FF with Wax Solution	15.0 – 20.0

5b. Chemical Containment Areas - Other

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	SSPC-SP13, Severe Service Abrasive Blast		SSPC-SP13, Severe Service Abrasive Blast	
1st Coat	201 Epoxoprime	6.0 – 8.0	CoroBond 100	6.0 – 8.0
2nd Coat	275 Stranlock	25.0 – 40.0	CorCote HCR Flake-Filled	15.0 – 20.0
3rd Coat	282 Tneme-Glaze	8.0 – 12.0	CorCote HCR	15.0 – 20.0

E. Wood - Interior or Exterior

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	151-1051 Elasto-Grip FC	1.0 – 1.5	Multi-Purpose Latex Primer	1.0 – 1.5
2nd Coat	1029 Tufcryl	2.0– 3.0 - 3.5	DTM Acrylic Coating	2.0 – 3.0
3rd Coat	1029 Tufcryl	2.0 – 3.0	DTM Acrylic Coating	2.0 – 3.0

F. Insulated Pipe

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	1029Tneme-Cryl	2.0 – 3.0	DTM Primer/Finish, B66W1	2.0 – 3.0
2nd Coat	1029 Tneme-Cryl	2.0 – 3.0	DTM Primer/Finish, B66W1	2.0 – 3.0

G. Gypsum Board

1. Interior Drywall - Architectural

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
1st Coat	151-1051 Elasto-Grip FC	1.0 – 1.5	PrepRite 200 Printer	1.0 – 1.5
2nd Coat	6-Color Tneme-Cryl	2.0 – 3.0	ProMar 200 F, SF, EgShel	1.0 – 1.5

2. Interior Drywall - Severe Exposure

	Tnemec	Dry Mils	Sherwin Williams	Dry Mils
Surface Prep	Surface Shall be Clean / Dry		Surface Shall be Clean / Dry	
Prime Coat	151-1051 Elasto-Grip FC	1.0 – 1.5	PrepRite 200 Primer	1.0 – 1.5
1st Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0 – 3.0
2nd Coat	113 H.B. Tneme-Tufcoat	2.0 – 3.0	Pro-Industrial Hi-Bild Waterbased Catalyzed Epoxy	2.0 – 3.0

H. PVC Piping – **Do Not Paint**

I. Aluminum Windows, Doors, Handrails & Grating – **Do Not Paint**

J. Fiberglass Reinforced Plastic Doors & Windows – **Do Not Paint**

3.08 PIPING COLOR CODE

To facilitate identification of piping in plants and pumping stations it is recommended that the following color scheme be utilized:

CHEMICAL LINES	
Alum or Primary Coagulant	Orange
Ammonia	White
Carbon Slurry	Black
Caustic	Yellow w/ green band
Chlorine	Yellow
Lime Slurry	Light Green
Fluoride	Light Blue w/ red band
Polymers or Coagulant Aid	Orange w/ green band
Potassium Permanganate	Violet
Soda Ash	Light Green w/ orange bandd
Sulfur Dioxide	Light Green w/yellow band

WATER LINES	
Raw Water	Olive Green
Settled Water	Light Blue
Filtered, Finished or Potable Water	Dark Blue

WASTE LINES	
Backwash Waste	Light Brown
Sewer (Sanitary or Other)	Dark Gray
Sludge	Dark Brown

OTHER	
Compressed Air	Dark Green
Gas	Red
Other Lines	Light Gray

3.09 STENCILING

A. The Contractor shall supply all materials and labor necessary for stenciling of legends on pipes. The legend shall show the name of the contents. Review by the Architect-Engineer of legends will be required. Names shall be "plainly visible". Arrows showing direction of flow shall also be stenciled on pipes. The legends shall be located not more than 10 feet apart and, in general, at each valve and piece of equipment. The size and location of the legend shall be in general accordance with ANSI A13.1-1981 "Scheme for the Identification of Piping Systems". All visible piping 6" in diameter and larger shall be color-coded and stenciled. "Stick-on" labels are not acceptable.

3.10 PLASTIC IDENTIFICATION MARKERS

A. All visible piping 3/4" and greater and less than 6" which is accessible for maintenance operations shall be color-coded and identified with semi-rigid plastic identification markers equal to SETMARK Pipe Markers as manufactured by Seton Name Plate Corporation, New Haven, Conn.; T & B/Westline, Los Angeles, California; or equal. Direction of flow arrows are to be included on each marker, unless otherwise specified.

B. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ANSI A 13.1 - 1981).

C. For pipes under 3/4" O.D. (too small for color bands and legends), brass identification tags 1-1/2" in diameter with depressed 1/4" high black-filled letters above 1/3" blackfilled numbers shall be fastened securely at specified locations.

D. All electrical conduits, which are accessible for maintenance operations, shall be identified with semi-rigid identification markers similar to those specified above.

E. Each marker background is to be color-coded with a clearly printed legend to identify the conductor. Size of markers and sizes of lettering to generally conform with the "Scheme for Identification of Piping Systems" (ANSI A 13.1 - 1981)

F. Locations for pipe and electrical markers to be as follows:

1. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).

2. At each branch and riser take-off.
3. At each pipe passage through wall, floor and ceiling construction.

4. At each pipe passage to underground.

5. On all horizontal pipe runs-marked every 25 feet.

3.11 PAINT SCHEDULE

All items at the Project site shall be painted in accordance with these Specifications and Drawings. The following paint schedule is provided only to assist the Owner and Contractor in selection of the appropriate paint system and is not intended to be a complete list of items to be painted.

A. Paint Application Schedule

	Location and/or Description		System
1.	Existing Water Plant Pipe Gallery		
	a.	Piping & Equipment	A
2.	Carbon Feed Facility		
	a.	Block Walls	C.1
	b.	Door and Frames, Exterior	A.1
	c.	Doors and Frames, Interior	A.6
	d.	Piping & Equipment	A
	e.	Concrete Floors	SEE SECTION 03300 – 3.15

END OF SECTION

SECTION 10520
FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 -GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers

2. Cabinets for portable fire extinguishers

B. Related Sections include the following

1. Section 09900, “Painting”.

1.02 REFERENCES

A. American Disability Act (ADA)

ADA Accessibility Guidelines (ADAAG)

B. American Society for Testing and Materials (ASTM)

A1008/A1008M	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
C1036	Standard Specification for Flat Glass
E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops

C. Federal Standard (FED-STD)

FED-STD-795	Uniform Federal Accessibility Standards (UFAS)

D. National Fire Protection Association (NFPA)

NFPA 10 Portable Fire Extinguishers

E. International Building Code (IBC)

F. International Fire Code (IFC)

1.03 SUBMITTALS

A. Submit brochure and product data.

1.04 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10.

B. Fire Extinguishers: Listed and labeled by Underwriter's Laboratory (UL) or Factory Mutual (FM) for type, rating, and classification.

PART 2 -PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Ansul Inc.
2. Larsen's Manufacturing Co.
3. Encon Safety Products

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A1008/A1008M, commercial quality, stretcher leveled, temper rolled.

2.03 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

1. Product: A 10-lb, multi-purpose, UL listed, dry chemical fire extinguisher with a minimum rating of 4-A:40-B:C..

B. Mounting Brackets: Manufacturer's standard steel bracket, designed to secure extinguisher, of sizes required for types and capacities of fire extinguisher indicated, with plated or baked-enamel finish.

C. Fire extinguishers installed outside shall be in approved weather-tight fire extinguisher cabinets.

2.04 FIRE EXTINGUISHER CABINETS

A. General: Unless specified otherwise on construction drawings, provide fire extinguisher cabinet of type, size, and rating as indicated below, or equivalent.

Trim Style & Projection	Inside Box Dimensions (H x W x D)	Manufacturer	Model #	Fire-Rated Model #	SNL Extinguisher Type
Recessed 5/16	24 x 9½ x 6	Larsen's	2409-R2	FS-2409-R2	I, III

Semirecessed 2½	24 x 9½ x 6	Larsen's	2409-6R	FS-2409-6R	I, III
Semirecessed 4½	24 x 9½ x 6	Larsen's	2409-RM	FS-2409-RM	I, III
Semirecessed 4½	27 x 12 x 8	Larsen's	2712-RM	FS-2712-RM	II
Surface Mounted (outdoor use only)	27¼ x 11½ x 8½	Encon Safety Products	01337003	N/A	I, II, III

B. Cabinet Size: The minimum inside box dimensions shall be 24"H x 9½W x 6"D for SNL Type I and Type III fire extinguishers, and 27"H x 12"W x 8"D for SNL Type II fire extinguishers.

C. Cabinet Construction: Provide manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

D. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E814 for fire-resistance rating of wall where it is installed. Construct fire-rated cabinets with double walls fabricated from 0.0478-inch (1.2-mm) thick, cold-rolled steel sheet lined with minimum 5/8-inch (16-mm) thick, fire-barrier material. Provide factory drilled mounting holes.

1. Cabinet Metal: Enameled-steel sheet.

2. Shelf: Same metal and finish as cabinet.

E. Cabinet Mounting: Suitable for the following:

1. Recessed: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.

2. Semi-recessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.

3. Surface Mounted: Cabinet box fully exposed and mounted directly on wall.

F. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded and ground smooth.

G. Cabinet Trim Material: Steel sheet.

H. Door Material: Steel sheet.

I. Door Glazing: Clear Float Glass, ASTM C1036, Type 1, Class 1

J. Door Style: Vertical duo panel with frame.

K. Door Construction: Provide a minimum ½-inch (13 mm) thick door frame.

L. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide recessed door pull and friction latch. Provide continuous-type hinge permitting doors to open 180 degrees.

M. Cabinet and Door Finishes: Provide manufacturer's standard baked enamel paint for the exterior and interior of the cabinet and doors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets are to be installed. Verify that rough openings for cabinets are correctly sized and located.

B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FIRE EXTINGUISHERS

A. Comply with manufacturer's written instructions for installing fire extinguishers and mounting brackets.

B. Mounting Height: Install extinguishers at heights indicated below.

1. Install fire extinguishers mounted on hangers or brackets attached to a wall so that the top of the fire extinguisher is not more than 3½ ft. above the floor.

2. In no case shall the clearance between the bottom of the fire extinguisher and the floor be less than 4 inches.

C. Locations: Install extinguishers at locations indicated below.

1. Install fire extinguishers at locations specified in the drawings or as directed by the authority having jurisdiction.

2. Fire extinguishers shall be conspicuously located, along normal paths of travel, including exits from areas. Extinguishers shall not be obstructed or obscured from view.

D. Install portable fire extinguishers on the hanger or in the bracket supplied, or place them in the fire extinguisher cabinets provided. Verify that the extinguisher operating instructions face outward.

3.03 INSTALLATION OF FIRE EXTINGUISHER CABINETS

A. Comply with manufacturer's written instructions for installing fire extinguisher cabinets.

B. Mounting Height: Install fire extinguisher cabinets at the height required so that the top of the fire extinguisher is not more than 54 inches above the floor.

C. Install fire extinguisher cabinets at locations specified on the drawings.

D. Fire extinguisher cabinets shall protrude no more than 4 inches into corridors, passageways, or aisles.

E. Repair/paint wall surfaces surrounding fire extinguisher cabinet damaged during installation to match existing wall surface.

3.04 SIGNAGE

A. Identify bracket-mounted extinguishers with the words “FIRE EXTINGUISHER” in red letter decals applied to wall surface.

B. Identify fire extinguisher in cabinet with the words “FIRE EXTINGUISHER” applied to door.

1. Application Process: Decals

2. Lettering Color: Red

3. Orientation: Vertical

3.05 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Construction Completion.

END OF SECTION

SECTION 11211

WATER SAMPLE PUMP

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and services for manufacturing, assembling, delivering, installing, testing, and placing in service all pumping equipment including pumps, motors, bases, and appurtenances.

B. Unless otherwise specified, the pump manufacturer shall furnish each pumping unit complete with drive motor and all other components and shall be held entirely responsible for the compatibility in all respects of all components furnished. Pumping units shall be as specified herein and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A.	Shop Drawings:	Section 01340
B.	Operations & Maintenance Manuals:	Section 01780
C.	Plumbing:	Division 15
D.	Electrical:	Division 16

1.03 DEFINITIONS

A. When the term "pumping unit" is used hereinafter, it shall be deemed to mean a pump or pumps, complete with, but not limited to, drive motor, connecting shafting, bearings, couplings, accessories, appurtenances, and all associated equipment.

1.04 CONTRACT DRAWINGS

A. The Contract Drawings are intended to show a general arrangement of pumping equipment, drives, structural supports, foundations, connected piping and valves.

B. The pump suction and discharges shown shall be considered minimum sizes unless otherwise specified.

1.05 MANUFACTURER

A. All pumping units shall be provided by a single manufacturer with a minimum of five (5) year's experience in designing and manufacturing pumping equipment of similar type, size and capacity.

B. Quality Assurance: All pumping units shall be of approved design and products shall be from manufacturers who have built equipment of similar type, size and capacity.

C. Additional Submittals: The Contractor shall submit, upon request, any additional information that the Engineer may deem necessary to determine the ability of the proposed manufacturer to produce the specified equipment.

D. Replacement Parts Capability: Pumping units shall be the products of manufacturers who can produce evidence of their ability to promptly furnish any and all interchangeable replacement parts as many be needed at any time within the expected life of the pumps.

Upon request, the Contractor shall submit full details of the proposed manufacturer's ability to promptly fill replacement orders.

E. Manufacturer Information: All manufacturer information required by the specifications shall be submitted by the Contractor within thirty (30) calendar days of the date of receipt of the Notice to Proceed.

1. Any additional information or data, specifically requested by the Engineer, concerning manufacturer's capabilities (especially relating to requirements described hereinbefore), shall be submitted by the Contractor within fourteen (14) calendar days of the receipt of the written request therefore, unless otherwise specified.

2. Approval of manufacturers or suppliers will not be given until all information required by the specifications or requested by the Engineer has been submitted and acceptable.

F. Disqualification of Manufacturer:

1. Failure to successfully comply with the provisions of subparagraphs A through D, inclusive, will constitute grounds for disqualification of pump manufacturer.

2. Poor performance of similar pumping equipment now in operation under the specified conditions of service and pump rating constitute grounds for disqualification of the pump manufacturer, supplier, or both, unless such poor performance has been corrected.

1.06 SUBMITTALS (SHOP DRAWINGS)

A. General: The Contractor shall comply with the provisions of the Specifications regarding submittals, unless otherwise specified herein.

B. Content of Submittals: The following shall be included in submittals as a minimum. However, any additional information or data shall be added if and whenever requested by the Owner or the Engineer. Where applicable, submit separate data for each pump.

1. Descriptive Literature:

a. Dimensions

b. Materials of Construction (including required coating)

c. Performance Data

2. Installation Information: Submit drawings and information necessary for final design of foundations, connecting piping and valves, pump drip and drainage piping, electrical connections, starting, speed regulating and protective equipment, and auxiliary equipment.

3. Maintenance and Operations Manual: Manual shall contain all information necessary for proper operation and maintenance of pumping units, as well as the location of the nearest permanent service headquarters.

1.07 TESTS

A. Field Tests

1. The field tests shall be made by the Contractor in the presence of and as directed by the Engineer. Testing shall be done in accordance with the Hydraulic Institute Standards.

B. Responsibility During Test

1. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

1.08 IDENTIFICATION - NAMEPLATES

A. Each piece of equipment shall be provided with a substantial name plate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, and principal rating data.

1.09 GUARANTEE PERIOD

A. The Contractor shall guarantee and warrant that the equipment furnished and installed is free from defects of design, material and workmanship, and will operate satisfactorily. In the event the equipment fails to perform as specified, and after the Owner has given due notice, the Contractor or Supplier, at their own expense, shall promptly repair or replace the defective equipment without any additional cost to the Owner.

B. After successful completion of tests and trials under operating conditions on all equipment, the Contractor shall guarantee all equipment and materials from undue wear and tear from mechanical and electrical defects, and from any failure whatever except those resulting from proven carelessness or deliberate actions of the Owner, for a minimum of one (1) year from Substantial completion as detailed in section 01120 “General Provisions”. This one (1) year minimum shall not replace a standard Manufacture’s guarantee if it exceeds one (1) year.

1.11 AMERICAN IRON AND STEEL

Under the 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 applies to

American Iron and Steel requirement to this project. All listed iron and steel products used in this project must be produced in the United States.

PART 2 - PRODUCTS

2.01 WATER SAMPLE PUMP

A. The Water Sample pump, where indicated on the Contract Drawings, shall be a self-priming, double head adjustable peristaltic metering pump and be of the following general design:

1.	Pump housing	-	Polycarbonate
2.	PSI Maximum	-	25
3.	Flow rate	-	8.5 to 170 gallons per day

B. Water Sample pump shall be Model 170DM5 as manufactured by Stenner Pump Company, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer’s recommendations.

3.02 MANUFACTURERS SERVICES

A. The Contractor shall include with his bid the services of the Equipment Manufacturer's field service technician.

B. This service shall be for the purposes of check-out, initial start-up certification, and instruction of plant personnel.

C. A written report covering the technician's findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

END OF SECTION

SECTION 11212

VERTICAL TURBINE PUMPS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and services for manufacturing, assembling, delivering, installing, testing, and placing in service all pumping equipment including pumps, motors, bases, and appurtenances.

B. Unless otherwise specified, the pump manufacturer shall furnish each pumping unit complete with drive motor and all other components and shall be held entirely responsible for the compatibility in all respects of all components furnished.

C. Pumping units shall be as specified herein, and shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A.	Submittals:	Section 01340
B.	Concrete:	Section 03300
C.	Precision Grouting:	Section 03600
D.	Piping & Valves:	Section 11290 and 11295
E.	Painting:	Section 09900
F.	Electrical:	Section 16220
G.	Operating & Maintenance Data:	Section 01780
H.	Precast Concrete:	Section 03405

I. Water Treatment Facilities Operating and Monitoring Systems: Division 17

1.03 DEFINITION

A. When the term "pumping unit" is used hereinafter, it shall be deemed to mean a pump or pumps, complete with, but not limited to, drive motor, connecting shafting, bearings, couplings, accessories, appurtenances, and all associated equipment.

1.04 CONTRACT DRAWINGS

A. The contract drawings are intended to show a general arrangement of pumping equipment, drives, structural supports, foundations, connected piping and valves.

B. The pump suction and discharges shown shall be considered minimum sizes unless otherwise specified.

1.05 MANUFACTURER

A. Quality Assurance: All pumping units shall be of approved design and make products of manufacturers who have built equipment of similar type, size and capacity.

B. Additional Submittals: The Contractor shall submit, upon request, any additional information that the Engineer may deem necessary to determine the ability of the proposed manufacturer to produce the specified equipment.

C. Replacement Parts Capability: Pumping units shall be the products of manufacturers who can produce evidence of their ability to promptly furnish any and all interchangeable replacement parts as many be needed at any time within the expected life of the pumps.

Upon request, the Contractor shall submit full details of the proposed manufacturer's ability to promptly fill replacement orders.

D. Manufacturer Information: All manufacturer information required by the specifications shall be submitted by the Contractor within thirty (30) calendar days of the date of receipt of the Notice to Proceed.

Any additional information or data, specifically requested by the Engineer, concerning manufacturer's capabilities (especially relating to requirements described hereinbefore), shall be submitted by the Contractor within fourteen (14) calendar days of the receipt of the written request therefore, unless otherwise specified.

Approval of manufacturers or suppliers will not be given until all information required by the specifications or requested by the Engineer has been submitted and acceptable.

E. Disqualification of Manufacturer:

1. Failure to successfully comply with the provisions of subparagraphs A through D, inclusive, will constitute grounds for disqualification of pump manufacturer.

2. Poor performance of similar pumping equipment now in operation under the specified conditions of service and pump rating constitute grounds for disqualification of the pump manufacturer, supplier, or both, unless such poor performance has been corrected.

1.06 SUBMITTALS (SHOP DRAWINGS)

A. General: The Contractor shall comply with the provisions of the specifications regarding submittals, unless otherwise specified herein.

B. Content of Submittals: The following shall be included in submittals as a minimum. However, any additional information or data shall be added if and whenever requested by the Owner or the Engineer. Where applicable, submit separate data for each pump.

1. Descriptive Literature:

a. Dimensions

b. Materials of Construction (including required coating).

c. Performance Data.

1) Size of Pump

2) GPM

3) TDH

4) BHP

5) Overall pump efficiency inlet thought discharge head)

6) RPM

7) Performance curves showing overall pump efficiencies.

8) NPSH curve if applicable)

9) Shutoff head

10) Weight of pump

11) Head

12) Rated HP of motor

13) Weight of motor

2. Installation Information: Submit drawings and information necessary for final design of foundations, connecting piping and valves, pump drip and drainage piping, electrical connections, starting, speed regulating and protective equipment, and auxiliary equipment.

   a. Submit details for mechanical seal assemblies.

   b. Submit drawings showing locations, size and full details of foundation bolts for all components for all pumping units.

   c. For all pumping units, a dimensioned and scaled assembly outline drawing or drawings of the complete pump, drive, and all associated equipment furnished shall be submitted for approval. Such drawing or drawings shall show plan, elevation, and any other views or sections requested.

   d. For all pumping units, a scaled cross-sectional drawing of the assembled pump showing full details and materials of construction shall be submitted for approval.

   e. The Contractor shall submit all other drawings, material lists and other information specified, requested and/or necessary to show complete compliance with all details of the contract documents.

3. Maintenance and Operations Manual: Manual shall contain all information necessary for proper operation and maintenance of pumping units, as well as the location of the nearest permanent service headquarters.

1.07 TESTS

A. Shop Tests:

1. The pumps shall be fully tested at the manufacturer's works before shipment at their rated speed, capacity, and head, and at such other conditions of head and capacity to establish that each has met all guarantees on the characteristic curves submitted. Testing shall be done in accordance with the Hydraulic Institute Standards, 1U acceptance grade. Five (5) certified copies of the results of these tests are to be sent to the Engineer. Also included with the test curves shall be a certified bill of material list depicting quality of construction. Such tests shall be accomplished at the manufacturer's facility prior to shipment.

B. Field Tests:

1. The field tests shall be made by the Contractor in the presence of and as directed by the Engineer. Testing shall be done in accordance with the Hydraulic Institute Standards.

2. Field tests shall be made on each pumping unit. Included therein, each pump shall be run at maximum rated speed for at least three (3) rates of flow corresponding to minimum rate, design rate, and maximum rate of flows specified as evidenced by the corresponding total dynamic head shown by the pump gages; simultaneous ammeter readings shall be taken. Variation of the rate of flow shall be made by throttling the discharge valve (where applicable). The rated motor nameplate current and power shall not be exceeded at any rate of flow within the specified range.

3. Before any pump is rotated, the Contractor shall make certain that no debris is present in suction well, pumps or pipe lines. Any internal damage done to equipment while starting up shall be assumed to be caused by debris and shall be replaced at the Contractor's expense. No pump shall be rotated under power unless filled with liquid.

4. When water can be pumped, the Contractor shall commence pumping and shall have representatives from the pump manufacturer to start the pumps. When flow conditions are favorable, the Contractor or pump manufacturer shall in the presence of the Engineer, run a series of tests to establish the adequacy of the pumping program.

C. Failure of Tests: Any defects in the equipment or failure to meet the guarantees or requirements of the specifications shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails or refuses to make these corrections or if the improved equipment, when tested, shall fail again to meet the guarantees of specified requirements, the Owner notwithstanding its 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 his own expense.

1. 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, and upon the receipt of said sum of money the Owner will execute and deliver to the Contractor a bill of sale of all its rights, title, and interest in and to said

rejected equipment; provided, however, that said equipment shall not be removed from the premises of the Owner until the Owner obtains from other sources the equipment to take the place of the rejected. The Owner hereby agrees to obtain said other equipment within a reasonable time and the Contractor agrees that the Owner may use the equipment furnished by him without rental or other charge until said other new equipment is obtained.

D. Responsibility During Test: The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

E. Manufacturer's Representative: For all pumping units, the Contractor shall furnish the services of accredited representatives of the pump manufacturer who shall supervise the installation, adjustment, and field tests of each pumping unit and give instructions to the operating personnel. As one condition necessary to acceptance of any pumping unit, the Contractor shall submit a certificate from the manufacturer, stating that the installation of the pumping unit is satisfactory, that the unit is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit.

1.08 IDENTIFICATION - NAMEPLATES

A. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number and principal rating date.

1.09 GUARANTEE PERIOD

A. The Contractor shall guarantee and warrant that the equipment furnished and installed is free from defects of design, material and workmanship, and will operate satisfactorily. In the event the equipment fails to perform as specified, and after the Owner has given due notice, the Contractor or Supplier, at their own expense, shall promptly repair or replace the defective equipment without any additional cost to the Owner.

B. After successful completion of tests and trials under operating conditions on all equipment, the Contractor shall guarantee all equipment and materials from undue wear and tear from mechanical and electrical defects, and from any failure whatever except those resulting from proven carelessness or deliberate actions of the Owner, for a minimum of one (1) year from Substantial completion as detailed in section 01120 “General Provisions”. This one (1) year minimum shall not replace a standard Manufacture’s guarantee if it exceeds one (1) year.

PART 2 - PRODUCTS

2.01 VERTICAL TURBINE PUMPS

A. General

1. The pumping units required under this section shall be complete including suction barrels and pumps with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.

2. All necessary anchor bolts, nuts and washers shall be furnished by the pump manufacturer for installation by the Contractor. Anchor bolts, nuts and washers shall be 316 stainless steel. A molybdenum disulfide anti-seize agent shall be supplied for use with all stainless steel bolts.

3. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed and all other pertinent data shall be attached to each pump, motor variable frequency drive and control panel.

4. Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine run-away speed of the unit due to back flow through the pump with the maximum TDH specified available at the pump discharge flange. The maximum reverse runaway speed shall not exceed 180 percent of the design pump maximum operating speed. A statement of compliance with this requirement must be furnished with the Shop Drawings submittal.

B. Pumps

1. General

a. The pumps shall be of the vertical turbine type. Each unit shall include a bowl assembly (strainer), column and open line shaft, enclosed impeller, discharge head and driver as specified. Water lubricated line shafts shall be provided. The pumps shall be equipped with an anti-vortex baffle to be mounted inside the basket strainer.

b. The pumps shall be built to standard dimensions such that parts will be interchangeable between like units and all units shall be supplied by the same manufacturer.

c. The pumps shall be as manufactured by National Pump Company, Wilo, American-Marsh, Christensen, Peerless, Fairbanks Morse, Flowserve, or Engineer approved equal.

2. Performance Requirements

a. When operating at the maximum output speed of the motor, each pump shall have a characteristic performance curve and which meets all the minimum conditions listed in the Vertical Turbine Pump Schedule. The pumps and drive motors shall be capable of operating satisfactorily under the full range of conditions as defined by the Pump Schedule. Motors shall be non-overloading throughout the range of operation.

b. Each pump shall be capable of continuous adjustable speed operation over the speed range from 100 percent to 60 percent of pump design speed. There shall be no significant change in vibration and noise level.

c. Maximum motor speeds shall not exceed those listed in the Vertical Turbine Pump Schedule to satisfy the specified hydraulic duty requirements. The pump design speed shall be the maximum output speed of the motor furnished, when operating at the pump's design capacity and head at 60 Hertz on utility power (full motor speed).

d. With the pumping units operating at full motor speed, the maximum brake horsepower required by the pumps shall not exceed the maximum horsepower listed in the Vertical Turbine Pump Schedule.

e. The pumps shall meet the requirements as listed in the table and shall be the model numbers as manufactured by American Marsh, Christensen, Peerless, Fairbanks Morse, Flowserve, or Engineer approved equal.

f. Each pump shall be designed for the conditions of service tabulated in the following Pump Schedule. The Contractor shall furnish, install and place into operation new vertical turbine pumps at the following locations, as shown on the Drawings:

VERTICAL TURBINE PUMP SCHEDULE

Parameter	GAC
Number of Pumps	2
Design Flow (GPM)	3,650
TDH (feet)	75
Shutoff Head (feet)	125
Operating Point	3,650 gpm @ 75' TDH
Operating Point at Runout	4,300 gpm @ 50' TDH
Speed Type	VFD
Horsepower (Per Pump)	100
Efficiency at Operating Point	82%
Max Speed (rpm)	1,750
Manufacturer	American-Marsh or equal
Model No.	16LC
Impeller	11.56"±
No. of Stages	1
Column/Discharge Size (Flanged)	10"
Min. Pump Shaft Diameter (In.)	1.0"

* Pumps shall be operated by VFD – see Specifications Division 16.

3. Pump Construction

a. The connection of the output shaft of the motor to the head shaft shall be made with a motor base coupling to allow low headroom removal of the motor. Impeller adjustments shall be made by the top adjusting nut in the VHS motor.

b. The pump shall be furnished with a suitable, integral fabricated ASTM A-36 steel mounting ring of adequate design with registered fit to match the mounting dimensions of the drive motor.

c. The discharge head shall be fabricated steel construction of ASTM A-36 steel, 3/8-inch minimum thickness and of the above base type and shall conform to the drawings with a flat faced flanged discharge connection conforming, dimensionally, to ANSI/AWWA A21.15/C115. The packing gland access openings shall be of adequate size to allow for packing adjustment and replacement and shall be protected by expanded metal screens constructed of 316 stainless steel.

d. Incorporated in the fabrication of the discharge head shall be a suitable pump support base not less than 1-1/2 inch in thickness of standard ANSI B16 B2 flanged dimensions to support both the pump and the motor. The flange bolting shall be in accordance with the requirements of ANSI B16 B2.

e. The discharge head will be fitted with an ASTM A-48 Class 30, bleed off type stuffing box, having an ASTM B-584 alloy 932 or 836 bronze stuffing box bearing, an ASTM B-584 alloy 932 or 836 bronze cage ring, ASTM B-584 allow 932 or 836 split packing gland and not less than four (4) rings of braided teflon packing.

f. The pump head shaft shall be constructed of ASTM A-276 416 or 17-4 P.H. stainless steel alloy. Shaft diameter shall be determined by ANSI B58.1 standards for Deep Well Vertical Turbine Pumps, Section A4.3.3, but in no case be less than the diameter shown in the Vertical Turbine Pump Schedule.

g. The pump column shall be constructed of ASTM A-36 steel, not less than Schedule 30, flanged at each end. The column shall mate with the pump bowl assembly and the discharge head with fits to assure correct alignment. The column assembly shall have guides fabricated to the column assembly. Each guide shall contain a water lubricated rubber bearing designed for vertical turbine pump service.

h. The pump line shaft shall be constructed of ASTM A-276 416 Stainless Steel Alloy and its diameter determined as described in 2.02 C.5 above but in no case shall it be less than the minimum diameter listed in the vertical turbine pump schedule. Line shaft shall have a hardened stainless steel shaft sleeve with a Brinnel hardness of 410/484.

i. The line shaft couplings shall be of the threaded type constructed of ASTM A-276 416 Stainless Steel Alloy and of such design that no threaded parts which could cause “galling” are interconnected. Alternate constructions must be of a design acceptable to the Engineer.

j. The pump impellers shall be of the mixed flow or radial type constructed of ASTM B-584 alloy 836 bronze accurate fitted and balanced. Enclosed impellers shall be fitted with ASTM B-584 alloy 32 or 836 wear rings. The impellers shall be attached to the shaft by means of a key constructed of ASTM A-276 316 Stainless Steel. The impellers shall be adjustable by means of a top shaft adjusting nut. The impeller shaft shall be of stainless steel of not less than 12% chrome content and shall be supported by bronze or neoprene bearings located on both sides of each impeller.

k. The pump bowls shall be constructed of ASTM A-48 Class 30 cast iron having a minimum tensile strength of 30,000 psi free from blow holes, sand holes, and all other faults. The pump bowls shall be of sufficient thickness to withstand stresses and strains at full operating pressure. The blows shall be subjected to a hydrostatic test 150 percent of that specified at the intermediate design condition. The bowls shall be designed and manufactured with open and smooth water passages to assure efficient, reliable operation.

l. If an enclosed impeller design is furnished, the bowls shall be fitted with ASTM B-584 alloy 932 or 836 bronze case wear rings. If an open or semi-open impeller design is furnished the bowl assembly shall be fitted with a replaceable impeller liner clamped between the suction bell and the first stage bow and thereafter between each stage. This replaceable liner shall be constructed of ASTM B-584 alloy 932 or 836 bronze.

m. The suction case bearings, and all intermediate bowl bearings shall be constructed of ASTM B-584 alloy 932 or 836 bronze.

n. Pump Coating: All portions of the column and pump discharge head not exposed to view, except for the interior of the bowls, shall have an interior and an exterior coating of high build modified epoxy of 6 to 8 mils dry thickness, compatible with the pump service. Surface preparation shall be in accordance with the coating manufacturer's recommendations.

o. Pump column/shaft shall have a nominal length of not over five (5) feet.

4. Motors

A. General

1) The motors for the pumps shall be of the vertical, hollow shaft squirrel cage induction type. Motor frames shall be of the WP-I design, with a max temperature rise of 60 degree C over a 40 degree C ambient.

2) Motors must be designed to accept all up thrust loads imposed by pump during starting and running. All pump motors shall have "high thrust" bearing design. All motors shall be equipped with non-reverse ratchet.

3) All motors shall be built in accordance with latest NEMA, IEEE, ANDI and AFBMA standards where applicable.

4) Motors shall conform to all requirements stipulated in PART 1 - GENERAL of this Section of the Specifications and with the specifications for motors included in Division 16.

5) The motors shall be compatible with the pumps.

6) Furnish motor base couplings to allow "low headroom" pump removal.

7) The Vertical Turbine pump motors shall be inverter duty rated in accordance with NEMA MG1, Part 31.

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

B. Take all necessary measurements in the field to determine the exact dimensions for all work and the required sizes of all equipment under this contract. All pertinent data and dimensions shall be verified by the Contractor.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Anchor bolts shall be set in accordance with the manufacturer's recommendations and setting plans.

B. Qualified supervisory services, including manufacturer's engineering representatives, shall be provided for a minimum of 4 man-days to insure that the work is done in a manner fully approved by the respective equipment manufacturer. The pump manufacturer's representatives shall specifically supervise the installation and alignment of the pump with the driver, the grouting, the alignment of the connection piping and the installation of the field-installed mechanical seal. If there are difficulties in the start-up or operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner. Services of the manufacturer's representatives and training shall be provided when the first pump is started, with follow-up visits upon start-up of each subsequent pump.

C. Connection of piping to pumps shall be done in presence of the Engineer. All piping connections to the pump shall be done without bending and/or twisting the piping to mate with the pump flange connections.

D. A certificate from each equipment manufacturer shall be submitted stating that the installation of his/her equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.03 FIELD TESTS

A. In the presence of the Engineer, such tests as necessary to indicate that the pumps, motors, and variable speed drives generally conform to the efficiencies and operating conditions specified shall be performed. A thirty-day operating period of the pumps will be required before acceptance. If a pump performance does not meet the Specifications, corrective measures shall be taken or the pump shall be removed and replaced with a pump which satisfies the conditions specified. All test procedures shall be in accordance with Hydraulic Institute Standards certified results of tests shall be submitted. Provide, calibrate and install all temporary gauges and meters, shall make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field acceptance tests. Written test procedures shall be submitted to the Engineer for approval 30 days prior to testing.

3.04 TRAINING

A. A factory representative shall provide a minimum of eight (8) man-hours of training to the Owner's operations staff concerning the recommended operation and maintenance of the equipment. Training shall be performed after substantial completion of the project with the use of operating equipment.

SECTION 11290

INTERIOR PROCESS PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all plant process piping as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Interior Process Valves: Section 11295

B. Piping furnished with equipment is included in the specific equipment item.

1.03 SUBMITTALS

A. The Contractor shall comply with the requirements of Section 01340 of these specifications.

B. A notarized certification shall be furnished for all pipe and fittings which verifies compliance with all applicable specifications.

1.04 AMERICAN IRON AND STEEL

Under the 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 applies to American Iron and Steel requirement to this project. All listed iron and steel products used in this project must be produced in the United States.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE/DUCTILE IRON FITTINGS

A. Unless otherwise noted or required, all inside ductile iron piping shall be flanged pipe with threaded flanges in accordance with AWWA C 115. All piping flanges shall have ring gaskets, 1/8-inch thick.

B. All exposed iron pipe to be field painted shall be furnished with an external coating of rust inhibitive primer, such as Tnemec Series 1 OmniThane, Sherwin-Williams Corothane I GalvaPac, or equal. Pipe manufacturer shall be responsible for compatibility of shop applied coatings with the field paint systems and products specified in Division 9, Section 09960. Do not apply asphalt or bituminous coatings on pipe to be painted.

C. The interior of all ductile iron pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C 104. Thickness of the lining shall be as set forth in Section 4.8.1 of the aforementioned specification unless otherwise directed by the Engineer.

D. Ductile iron fittings shall conform to AWWA C 110 with flanges faced and drilled to Class 300 or Class 125 as indicated on the Drawings. Fittings shall have interior lining and exterior coating same as the pipe.

2.02 POLYVINYL CHLORIDE (PVC) PLASTIC PRESSURE PIPE

A. PVC Pressure Pipe, 3" and Smaller: Polyvinyl chloride plastic pipe shall be ASTM D 1785 Schedule 80 or F441 CPVC, Schedule 80 with solvent weld joints. Fittings shall be ASTM D 2467 Schedule 80 socket type. All socket type connections shall be made with PVC solvent cement complying with ASTM D 2564 PVC solvent cement shall be furnished from the same supplier as the PVC pipe. Provide socket-threaded adapters for connection to threaded appurtenances where required.

2.03 COPPER PIPING

A. Copper piping shall be ASTM B 88 Type L seamless copper water tube, with ANSI B16.18 cast brass solder joint pressure fittings. Provide solder joint-threaded unions at all threaded valves and appurtenances.

2.04 STAINLESS STEEL

A. Stainless steel pipe shall be ASTM A 312, AISI Type 316. Schedule 40, threaded. Stainless steel fittings shall be AISI Type 316, 150-lb., threaded, as manufactured by Camco Fittings Company, Hamden, Connecticut, or equal.

2.05 CHEMICAL FEED PIPING

A. Chemical feed piping shall be as specified in Section 11240 Chemical Feed Equipment, included hereinafter.

2.06 WALL PIPE AND SLEEVES

A. All wall pipe shall be furnished with cast or welded collar water stops in the positions shown on the Drawings. Welding of water stop collars on pipe shall be accomplished by the wall pipe manufacturer in their shop. All centrifugally cast wall pipe shall be ductile iron meeting the requirements of AWWA C151 for the pipe barrel, conforming to the pressure rating of the pipeline in which installed, and in no case be lighter than Class 53.

B. All statically cast wall pipe shall be ductile iron meeting the requirements of AWWA C110 for fittings. Mechanical joint end and cast-on flange end wall pipe shall conform to AWWA C110 and threaded flange wall pipe shall conform to AWWA C115. Where flanged or mechanical joint bell ends are flush with the wall, they shall be drilled and tapped for stud bolts which are to be of 300 Series stainless steel.

C. The length of all wall pipe shall be not less than the thickness of the wall in which installed. Wall pipe shall have the same pressure rating as connecting pipe. All wall pipe shall be cement-mortar lined per AWWA C104. The outside of wall pipes shall be left uncoated and shall be field primed for painting on the portion exposed, uncoated where embedded and field coated with standard bituminous coated where buried.

D. Contractor may have the option to install wall pipe flush face-to-face of wall in lieu of the dimensioned length wall pipe shown on the Drawings, in order to eliminate form penetrations. This option will be subject to Engineer`s review at each wall pipe location and covers both flanged and mechanical-joint bell-end wall pipe. Embedded flanged and M.J. bell-end bolt holes shall be tapped for stud bolts; tapped bolt holes in embedded flanges shall be plugged for protection during concrete pouring.

E. All pipe wall sleeves shall be plain end galvanized steel pipe of diameter noted on Drawings and length to fit flush face-to-face of wall.

2.07 INTERLOCKING LINK PIPE SEALS

A. In all locations indicated on the Drawings, interlocking link pipe seals shall be used in lieu of lead packing a pipe wall sleeve. Seals shall be modular mechanical type, consisting of

interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. Seals shall be "Link-Seal" as manufactured by Thunderline Corporation, Wayne, Michigan, or approved equal.

B. The Contractor shall determine the required diameter of each individual wall opening according to the manufacturer's recommendations before ordering and installing the seal. Pipe shall be accurately centered in the sleeve and the link seals shall be sized, installed and tightened in accordance with the manufacturer's instructions.

2.08 COUPLINGS AND ADAPTERS

A. Flexible couplings shall be of the sleeve type with a middle ring, two round-wedge shaped rubber gaskets at each end, two following rings together and compress the gasket against the pipe. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

B. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

C. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings:

1. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe -

Dresser	Smith-Blair
Style 253 (2"-15")	4ll
Style 38/138 (18" & above)	

2. Transition couplings for joining pipe of different outside diameters-

Dresser	Smith-Blair
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")
	433 cast (2"-16")
	435 cast (2"-12")

3. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Smith-Blair
Style 227 cast (3"-12")	912 cast (3"-12")
Style 128 steel (3"-48" D.I. Pipe)	913 steel (3" and C.I. Pipe)
Style 128 steel (2"-96" steel pipe)	

2.09 FLANGED JOINTS

A. Flange bolts and nuts shall be ASTM A 307, Grade B and shall have hexagonal heads. All bolts, nuts and studs for flanged pipe in submerged locations shall be of 300 Series stainless steel. The flanges shall be drawn together until the joint is perfectly tight, with bolts of a length such that they will not project greater than 1/4-inch from the nut nor fall short of the end of the nut when drawn up. No washers shall be used. Gaskets shall be carefully fabricated prior to installation and must be suitable for pressure rating for the pipe for which it is used.

B. All flanges (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 125-pound for ductile iron and ANSI B16.5 150-pound for steel.

C. At the Contractor's option, and at no additional expense to the Owner, the following patented SBR flange gaskets or approved equal may be substituted for standard sheet packing ring gaskets in ductile iron flanged pipe:

1. TORUSEAL by American Cast Iron Pipe Company

2. FLANGE-TYTE by United States Pipe & Foundry Company

When using such gaskets, flange bolts shall be torqued to manufacturer's recommended torque values.

2.10 METAL PIPE SUPPORTS AND HANGERS

A. The Contractor shall furnish and install all pipe hangers, inserts, brackets, plates, anchors, and other supports not specifically included under other items. Generally pipe supports are not shown on the Drawings, but shall be supplied as specified herein. However, any bracing or support details shown on the Drawings shall be followed.

B. Prior to installation, the Contractor shall submit to the Engineer for review, manufacturer's data sheets on all catalogued items to be used and sketches covering all specially designed hanger and support assemblies and fabrications.

C. Supports and hangers shall be as manufactured by Grinnell, Elcen, or Fee & Mason, or equal or fabricated by the Contractor. Field fabricated supports may be used only for special conditions where manufactured items may not be suitable. In such cases, details of proposed supports shall be submitted to the Engineer for review. All such supports shall be galvanized.

D. Except as shown on the Drawings or as directed by the Engineer, supports and hangers shall be as follows:

1. Pipes with centerlines less than 24 inches from a wall shall be supported by a typical wall support bracket. Pipes with centerlines less than 6 feet above a floor shall be supported from below. All other pipes shall be hung from above. Piping shall be supported at no greater than 10 feet 0 inches on centers.

2. Pipe supported from underneath shall have adjustable pipe saddle supports on properly sized pipe stanchions. The saddle assembly shall be of cast iron. Standard pipe stanchions with hold-down "U" bolts shall be Grinnell Fig. 259, Elcen Fig. 49, Fee & Mason Fig. 2595, or equal.

3. Hangers are to be suspended from concrete work. Hangers shall be supported from approved metal inserts placed in concrete before the concrete is placed. Standard concrete inserts shall be Grinnell Fig. 28l or 282, Elcen Fig. 86 or 65, Fee & Mason

Fig. 186 or 2570, or equal. If special support from overhead concrete is necessary due to unusually heavy loads, support shall be as detailed on the Drawings. In no case shall standard concrete inserts be used where pipe load exceeds the manufacturer's recommended load for the insert, or where the hanger rod exceeds 7/8" diameter.

4. All pipe hangers, inserts, clamps, supports and other like items shall be submitted for review by the Engineer prior to installation.

5. All inside horizontal flanged piping shall be supported with approved split ring type adjustable hangers of malleable iron with suitable hanger rods unless shown otherwise on the Drawings. Special supports shall be constructed in accordance with details shown on the Drawings. Wall supports and/or hangers shall be placed not over 10 feet apart. All piping shall be rigidly supported to prevent loosening under vibration.

6. Pipe, valve operating stems, fixtures and conduits shall be bracketed or suspended from walls, ceilings, and beams at or near valves and fittings and where needed for firm support, by standard brackets, rods, turnbuckles, and rings made especially for pipe of sizes supported. Perforated strap iron and/or copper will not be acceptable.

7. Clevis hangers for "iron pipe size" O.D. pipe shall be Grinnell Figure 65, Elcen Figure l2, Fee & Mason Figure 239, or equal. Clevis hangers for Cast Iron O.D. pipe shall be Grinnell Figure 260, Elcen Figure 12C, Fee & Mason Figure 104, or equal. All clevis hangers shall be galvanized.

8. Turnbuckles shall be forged steel. Rods shall be of black steel, machine threaded of following sizes:

Pipe Size	Rod Diameter
1/2" - 2"	3/8"
2 1/2" - 3"	1/2"
4" - 5"	5/8"
6"	3/4"
8" - 12"	7/8"
14" - 16"	1"
18"	1 - 1/8"
20" - 24"	1 - 1/4"

9. Brackets shall be of standard castings of fabricated steel and shall be reviewed by the Engineer. Standard catalogued bracket shall be medium duty Grinnell Fig. 195, Elcen Fig. 57, Fee & Mason Fig. 151, or equal, galvanized, size as noted on Drawings. Provide light or heavy duty brackets if specifically noted on Drawings. "U" bolts shall be Grinnell Fig. 137, Elcen Fig. 68 or 68A, Fee & Mason Fig. 176, or equal.

10. Column type pipe supports shall consist of pipe columns of size required to carry the full pipe and standard cast iron bases and saddles as required. Saddles shall be of proper size to fit the pipe being supported.

2.11 INSULATION AND HEAT TRACING

Where indicated on the Contract Drawings or stated in the specifications, process piping shall be provided with insulation and heat tracing cables.

A. Insulation shall be one-piece fiberglass section insulation (K=0.23 at 75 degrees F.) with factory applied white reinforced kraft/foil vapor barrier jacket. Longitudinal jacket laps and butt joints shall be self-sealing using 3” wide lap strips. Insulation shall be one of the following:

1. Johns-Manville “Flame Safe AP-T 500 degrees F.”

2. Owens/Corning “Fiberglass 25 ASJ/SSL”.

3. Certainteed “Fiberglass 500 Degree Snap-On”.

Insulation shall be 1” thick, minimum.

B. Finishing Materials:

1. Acceptable manufacturers, insulating cement:

a. Johns-Mansville No. 375.

b. 48 Insulations “Quik-Set”.

c. Rockwood Mfg. Co. “Delta-Maid One Shot”.

2. Acceptable manufacturers, breather mastic:

a. Benjamin Foster “Sealfas 30-36”.

b. Insul-Coustic “Permsure IC-102”.

c. Vimasco No. 713.

d. Childers “Chil-Seal CP-50”.

e. Epolux “Cadalog 336”.

3. Acceptable manufacturers, PVC premolded covers:

a. Johns-Manville “Zeston”.

b. Ceel-Co.

c. approved equal

C. Heat tracing system shall be as specified in Division 15, Thermal Insulation, suitable for use on CPVC or stainless steel pipe, as applicable, and for a temperature range of 40 degrees to 102 degrees. Components of the heat tracing system shall be coordinated as to type, wattage and quantity of cables, type and thickness of insulation, type and diameter of pipe per manufacturer’s recommendation.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING

A. Materials shall be new and of the best grade and quality; workmanship shall be first class in every respect.

B. Each piece of iron pipe and each fitting shall be plainly marked at the foundry with class number and weight.

C. Where indicated on the Drawings, plain-end pipe shall be joined by means of flanged adapters or flexible couplings which shall be Rockwell, Dresser, or equal.

D. All pipe couplings shall be designed to safely withstand the operating pressure of the lines in which they are installed. All couplings shall be shop primed with an approved rust inhibitive primer.

E. Taps and connections to piping shall be made as required to connect equipment, sample lines, etc., and where otherwise shown on the Drawings.

F. Piping shall be installed straight and true, parallel or perpendicular to walls, with approved offsets around obstructions. Standard pipe fittings shall be used for changing direction of piping. No mitered joints or field fabricated pipe bends are permitted unless accepted by the Engineer.

G. All piping, fittings, valves and other accessories shall be thoroughly cleaned of dirt, chips and foreign matter before joint connections are made.

H. All plastic pipe shall be adequately supported and braced. Support spacing shall not exceed the recommendations of the Plastics Pipe Institute.

I. Teflon tape shall be used on all plastic pipe threaded connections.

J. Field cut male threads on plastic pipe shall be made with plastic pipe threading dies.

K. The annular space of plain wall sleeves shall be packed tight with lead wool to within 3/4" of wall face and then patch grouted flush to wall face with non-staining nonshrink grout, Masterflow 713 by Master Builders, Sonogrout by Sonneborn-Contech, or equal.

L. All pipe sleeves passing through walls or floors of chlorine feed and storage areas shall be provided with gas tight seals.

M. All pipe threads shall conform to ANSI B2.1.

N. Piping shall be erected to provide for expansion and contraction.

O. Screwed or soldered unions shall be provided in all small piping as required to permit convenient removal of equipment, valves and piping accessories from the piping system.

P. Dielectric insulating couplings or brass adapters shall be used whenever the adjoining materials being connected are of dissimilar material such as connections between copper tubing and steel pipe.

Q. All inside piping shall be color coded, stenciled and label tagged for identification as specified in Section 09900.

3.02 INSTALLATION OF PIPELINE INSULATION

A. Piping:

Butt all joints firmly together and secure all “self-seal” jacket laps with lap adhesive. Seal all butt joints with joint strips furnished with insulation. Taper all pipe insulation ends and cover with insulating cement.

B. Fittings and valves:

1. Hot lines 2” and smaller: Valves, unions, and flanges shall not be insulated.

2. Hot and cold lines 2-½" and larger and cold lines 2" and smaller: Valves, unions, and flanges shall be insulated as follows, but insulation shall be removable to facilitate maintenance.

3. Insulate with molded fiberglass fitting segments of pipe covering, or with firmly compressed fiberglass blanket. Secure in-place with 20 gauge galvanized steel wire and finish with a smooth coating of insulating cement. Pipe sizes under 4" may be insulated with hydraulic cement. All thicknesses shall be equal to that of adjoining pipe insulation.

4. Finish insulation with two (2) 1/16" thick coats of mastic, applied at not more than 15 sq. ft. per gallon and reinforced with white glass fabric embedded between the coats. (Use breather mastic on hot pipe lines and vapor barrier mastic on cold pipelines). Lap the glass fabric on itself and on adjoining pipe insulation.

5. Option: Factory premolded PVC fitting covers may be used. Premolded covers shall overlap the adjoining pipe insulation and jackets and shall be secured at all edges with vapor barrier adhesive on cold pipes. Secure ends of all covers with pressure sensitive vinyl tape which shall overlap both the jacket and the cover at least 1". On fittings where temperature exceeds 250 degrees F., two layers of insulation shall be applied with a few wrappings of twine on the first layer to eliminate any voids or hot spots.

3.03 HEAT TRACING SYSTEM INSTALLATION

A. Heat tracing system shall be coordinated and installed per manufacturer's recommendations.

END OF SECTION

SECTION 11295

INTERIOR PROCESS VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all new valves as shown on the Drawings and/or specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Interior Process Piping: Section 11290

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering. Comply with provisions of Section 01300.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

1.04 AMERICAN IRON AND STEEL

Under the 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 applies to American Iron and Steel requirement to this project. All listed iron and steel products used in this project must be produced in the United States.

PART 2 - PRODUCTS

2.01 PLUG VALVES

A. All plug valves shall be eccentric plug valves unless otherwise specified.

B. Valves shall be of the non-lubricated eccentric type with flanged ends faced and drilled per ANSI B16.1 125 lb.

C. Valve bodies shall be flushing body type and made of ASTM A126 Class B cast iron. Valves shall be furnished with a 1/8" welded overlay seat of not less than 95% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

D. Plugs shall be made of ductile iron and have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with settled sludge.

E. Valves shall have replaceable sleeve type bearings and grit seals at the upper and lower

journals.

F. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

G. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.

H. Manually operated valves 4-inch and larger shall have a worm gear actuator, stainless steel input shaft and handwheel operator. Manually operated valves 3-inch and smaller shall have a lever operator. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft shall be stainless steel and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be stainless steel.

I. Any cylinder actuators shall be equipped with 2-inch square operating nuts to allow manual valve operation in case of supply failure. Electric motor actuated valves shall comply with specification Section 13400.

J. Valves shall provide drip tight shutoff up to the full pressure rating. Valves shall be provided with adjustable limit stops and rotate 90 degrees from fully opened to fully closed.

K. Valves located 6 feet or more above the floor shall be furnished with chain wheel operators.

L Valves shall have rectangular port openings for throttling service, and shall open to 100% of the corresponding pipe diameter.

M. Plug valves shall be as manufactured by DeZurik, VAG USA., M&H or approved equal,

2.02 GATE VALVES

A. Gate valves 4" and larger shall conform with AWWA C-509 standard, and shall be of the resilient seat type, iron body, fully bronze mounted, non-rising stem and have a design working pressure of 200 psi. Valves shall be of standard manufacturer and of the highest quality both as to materials and workmanship.

B. Valves ends shall be flanged and shall conform to ANSI B16.1 class 125 and be handwheel operated, unless otherwise shown on the Drawings or specified hereinafter.

C. An epoxy coating conforming to AWWA C-550 shall be applied to the interior and exterior ferrous surfaces of the valve except for finished or seating surfaces.

D. All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve.

E. Gate valves shall be as manufactured by Mueller Co., M&H, Clow, American Valve & Hydrant, Kennedy, or equal.

2.03 CHECK VALVE

A. The valve is a counterweighted, rubber seated check valve with attached cushion chamber whose function is to permit flow in only one direction, close tightly when its discharge side pressure exceeds its inlet pressure, and to close without a slam or bang.

B. The swing check valve shall be constructed with heavy cast iron or cast steel body with a bronze or stainless steel seat ring, a non-corrosive shaft for attachment of weight and lever, and complete non-corrosive shockless chamber.

C. It shall absolutely prevent the return of water, oil or gas back through the valve when the inlet pressure decreases below the delivery pressure. The valve must be tight seating, and must be shockless in operation. The seat ring must be renewable.

D. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The shock absorption shall be by air, and the cushion chamber shall be so arranged that the closing speed will be adjustable to meet the service requirements.

E. The valve disc shall be of cast iron or cast steel and shall be suspended from a non-corrosive shaft which will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.

F. All material and workmanship shall be first class throughout and the purchaser reserves the right to inspect this valve before shipment.

G. The valves will be GA Industries, Inc. Fig. No. 250-D, 125# or equal.

2.04 BUTTERFLY VALVES

A. All butterfly valves shall be manufactured in strict accordance with the latest revision of AWWA C504, class 150B and conform to NSF Standard 61. Butterfly valves shall be of the tight closing, rubber (or synthetic rubber) seat type. Valves shall be bubble tight at the rated pressure in either direction and shall be satisfactory for applications involving throttling service and/or frequent operation and for applications involving valve operation after long periods of inactivity. All valves under this specification, unless indicated otherwise on the Drawings, shall be rated for 150 psi.

B. The valve disc shall rotate 90° from the full open position to the shut tight position. The valve disc shall be constructed of cast iron ASTM A-126, class B or ASTM A48, class 40. The cast iron disc shall have a continuous (non-segmented) type 316 stainless steel edge. The valve disc shall be connected to the shaft by type 316 stainless steel pins or torque screws.

C. Valve bodies shall be constructed of cast iron ASTM A-126, class B, and shall have flanged ends in accordance with ANSI B16.1 class 125. Valve bodies shall have rubber seats, be of one-piece construction, and be simultaneously molded and bonded to the valve body. The method used for bonding shall be tested in accordance with ASTM D429 method A or B. No metal-to-metal seating surfaces will be permitted. Valves shall meet the full structural requirements of AWWA C 504. The valve manufacturer shall recommend the type of rubber seat to be used and shall be suitable for its intended service.

D. The shafts shall be turned, ground and polished. Valve shafts shall be a one piece unit extending completely through the valve disc and body. Valve stems shall be constructed of type 304 stainless steel with their diameters per AWWA C504, Class 150B.

E. The shaft seals shall be provided to prevent leakage into the bearing chest areas. Shaft seals shall be made of a rubber suitable for the intended service and shall be a packing gland utilizing a self-compensating "V" type packing.

F. Valves shall have upper and lower (each side of disc) shaft bearings. Shaft bearings shall be of a self-lubricating, non-metallic construction. The valve manufacturer shall recommend the type of bearing to be used and shall be suitable for its intended service.

G. All surfaces of the valve shall be clean, dry and free from grease before painting. The valve surfaces except for disc, seating and finished portions shall be evenly coated at the factory with a suitable rust inhibitive primer. Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C 504.

H. Butterfly valves shall be Series 820 as manufactured by Homestead Water Products a division of Olson Technologies, Inc., or approved equal.

I. Butterfly Valve Operators

Valves shall be positioned to provide for the most convenient possible installation position for the valve actuator.

1. Manual Valve Operators

Manually operated valves shall be operated using a cast iron housed handwheel or chain wheel, as required, available in standard weatherproof construction. All units shall have adjustable open and close position stops, with provisions to prevent accidental adjustment changes. The operating shaft shall be supported, axially and radially, at the input end by permanently lubricated bronze thrust and sleeve bearings. All units shall be provided with a pointer assembly for valve position indication.

Manual valves located six (6) feet or more above finished floor level shall be furnished with chain wheel operators. Chains shall extend to within four (4) feet off the floor. All NRS floor stands and geared operators shall be indicating type.

2. Electric Motor Valve Operators

a. General: Electric motor operators shall be designed to move the valve from fully open to fully closed with operating speeds such that no undue surge or water hammer occurs when electrical power is applied, and hold the valve disc in any intermediate position between fully open to fully closed without creeping or fluttering. Valve, gear, reducer, electric motor operator and accessories shall be furnished complete, ready for installation.

b. Actuator and Gearing: The actuator shall be of worm and gear, single reduction design with provision for input spur or bevel gear assemblies to meet a given rim pull or input torque requirement. The input shaft of the manual shall be an extension of the worm shaft, which is a hardened alloy steel. The mating worm gear shall be alloy bronze, accurately cut by hobbing machines. All gearing shall be greased lubricated. Ball or roller bearings shall be used to provide smooth rotation of the worm shaft.

1) All units shall be provided with a pointer assembly for valve position indication.

2) All units shall be readily field adaptable to motor operation without disassembly of the manual actuator.

3) The actuator shall comply with AWWA C-504 specifications.

c. Mechanical Stops: The actuator shall house an adjustable mechanical stop device to prevent travel beyond the valve requirement. The stop shall allow valve travel of 90□ with a minimum adjust ability of +5□. All stops shall be of steel material.

d. Output Drive: The actuator shall have a removable splined adapter which shall be machined to accept the valve shaft. This adapter material shall be of carbon steel.

e. Electric Actuator: The electric valve actuator shall include the motor, operator unit gearing, limit switch gearing, limit switches, torque switches, stem nut, declutch lever, and auxiliary handwheel, as a self-contained unit. The actuator shall meet AWWA-C-504-87 specifications.

f. Enclosure: The valve actuator motor and all electrical enclosures shall be NEMA 4X, weatherproof, with a 120 volt heater, powered from an internal control power transformer. Unit shall be furnished with a reversing contactor suitable for mounting at any angle. Local control to be provided by a three position selector switch, OPEN-OFF-CLOSE, and a padlockable REMOTE-OFF-LOCAL selector switch. A unit mounted disconnect switch shall be provided which disconnects all ungrounded legs of the power connection.

g. Motor: The motor shall be specifically designed to operate on 460 volt three phase for valve actuator service and shall be of high starting torque, totally enclosed, nonventilated construction. Motor leads shall be brought into the control compartment or limit switch compartment without external piping or conduit boxes. Motor insulation shall be a minimum NEMA Class B with winding thermostat and a 15 minute rating without exceeding temperature rise.

1) The motor shall be of sufficient size to open or close the valve against the maximum expected differential pressure within 60 seconds when voltage of the motor terminals is 10 percent above or below nominal voltage. The motor duty rating shall be 15 minutes without exceeding its temperature rating. The motor shall be prelubricated and all bearings shall be of the anti-friction type.

h. Electric Actuator Gearing: The actuator shall be a double reduction unit with the capability of changing the output speed with a relatively fast, simple gear change. The power gearing shall consist of spur or helical gears and worm gearing. The spur or helical gearing and work shall be of hardened alloy steel and the worm gear shall be alloy bronze. All gearing shall be accurately cut with hobbing machines. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout.

i. Position Limit Switch: Position limit switches and associated gearing shall be an integral part of the valve actuator. Limit switch gearing shall be of the intermittent type, made of bronze or stainless steel, grease-lubricated, and enclosed in its own gear case to prevent dirt and foreign matter from entering the gear train. Switches shall be adjustable, allowing for trip points from fully open to fully closed positions of valve travel. They shall not be subject to breakage or slippage due to over travel.

1) Limit switches shall be of the heavy duty, open contact type with a rotary wiping action.

2) Each valve actuator shall have a minimum of eight heavy duty contacts with two or four rotor-type switch assemblies. Limit switches shall shut-off the actuator once a desired valve disc location is reached in position seat application.

3) The gear limit switch and torque switch shall carry a standard pilot duty rating as tabulated below:

Voltage	Normal Current	In Rush Current
460 A.C.	1.75 Amps	7.5 Amps

j. Torque Switch: Each valve actuator shall be equipped with a double torque switch which is responsive to loads encountered in both the opening and closing direction. Each side of the switch shall have a graduated dial and shall be adjustable. A calibration tag shall be mounted near each switch correlating the dial setting with the unit output torque. The torque switch shall operate during the complete valve cycle without the use of auxiliary relays, linkages, latches, or other devices. The torque switch shall be designed to shut off the actuator motor in the event that abnormally high torque is realized in either direction of travel. The torque switch is utilized as a protective device in valve applications requiring position seating.

k. Manual Operation: A handwheel shall be provided for manual operation. The handwheel shall not rotate during motor operation. A fused motor shall not prevent manual operation. When in manual operating position, the unit will remain in this position. The actuator will remain in motor position when the motor is energized. The actuator will remain in motor position until handwheel operation is accomplished by a positive declutching lever which disengages the motor and related gearing mechanically but not electrically. It shall not be possible for the unit to be simultaneously in manual and motor operation.

l. Electrical Requirements: The actuator shall be powered by a clearly defined 460 volt, 3-phase power, and all controls shall function on a stated control source and voltage. Electrical controls to be supplied by the actuator manufacturer as indicated in the specifications.

m. Manufacturer: Electric motor operators shall be as manufactured by Rotork Controls or approved equal.

n. Actuator shall include a 4-20 mA positioner and a 4-20 mA position feedback transmitter.

2.05 VALVE OPERATORS

A. Valve operators shall be as shown on the plans and specified herein Valves shall be positioned to provide for the most convenient position of the actuator possible and oriented to allow easy visual confirmation of valve position.

B. Valves located six (6) feet or more from floor level shall be furnished with chain wheel operators or chainlevel operators. Chains shall extend to within four (4) feet off the floor. All NRS floor stands and geared operators shall be indicating type.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with the manufacturer’s recommendations.

3.02 MANUFACTURER'S FIELD SERVICE

A. Manufacturer's authorized representative shall be present at the jobsite for assistance during equipment start-up and to train owner's personnel in the operation, maintenance and troubleshooting of the equipment provided.

3.03 GUARANTY

A. The Contractor shall guarantee and warrant that the equipment furnished and installed is free from defects of design, material and workmanship, and will operate satisfactorily. In the event the equipment fails to perform as specified, and after the Owner has given due notice, the Contractor or Supplier, at their own expense, shall promptly repair or replace the defective equipment without any additional cost to the Owner.

B. After successful completion of tests and trials under operating conditions on all equipment, the Contractor shall guarantee all equipment and materials from undue wear and tear from mechanical and electrical defects, and from any failure whatever except those resulting from proven carelessness or deliberate actions of the Owner, for a minimum of one (1) year from Substantial completion as detailed in section 01120 “General Provisions”. This one (1) year minimum shall not replace a standard Manufacture’s guarantee if it exceeds one (1) year.

END OF SECTION

SECTION 11350

GRANULAR ACTIVATED CARBON FEED SYSTEM

PART 1 - GENERAL

1.01 The contractor shall furnish all labor, materials, equipment and incidentals required and deliver, and place into satisfactory operation, one complete Granular Activated Carbon Feed System as specified herein and as shown on the plans.

1.02 References

A. ASME Section VIII, Division 1 – American Society of Mechanical Engineers Boiler and Pressure Vessel Code
B. ASME/ANSI B16.5 – American Society of Mechanical Engineers/American National Standard Institute
C. Steel Structures Painting Council Surface preparation Specifications and National Association of Corrosion Engineers
D. ASME Section II, American Society of Mechanical Engineers – Materials, Parts A, B & C
E. American Society of Testing Materials (ASTM)
F. American Water Works Association (AWWA) – B604, Standard for Granular Activated Carbon
G. NSF/ANSI Standard 61: Drinking Water System Components – Health Effects
H. NSF/ANSI Standard 372: Drinking Water System Components – Lead Content

1.03 System Description

A. Contractor will furnish three (3) GAC adsorption systems. The GAC systems shall be manufactured by Calgon AquaKnight GC 12-40, Aqueous Vets PF 12-1140 LowPro or approved equal. The GAC media shall be selected by the Owner/Engineer per the Allowance. The complete adsorption system includes the following.
   a. Carbon adsorbers with internals for carbon or ion exchange for retention
   b. Activated carbon (selected by Owner/Engineer per Allowance post bid)
   c. Influent, effluent, and backwash piping with valves
   d. Media fill and discharge piping with valves
   e. Vent and pressure relief piping
   f. Water piping and utility connections
   g. Accessories as shown below
   h. Manufacturer's services
B. The vessels, piping, valves, and media function as a system and are the end products of Calgon Carbon Corporation, Aqueous Vets or approved equal, to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.

1.04 Supplier's Qualifications

A. The Contract Documents are based upon Calgon Carbon Corporation's Aqua Knight 12-40 and/or Aqueous Vets PF 12-1140 LowPro system. Other suppliers must receive written approval from the engineer to be considered equal. Alternative suppliers must submit the following information for pre-approval two weeks prior to bid date. Bidders who have not received pre-approval will not be acceptable

B. Supplier of the adsorption system will have the following minimum qualifications and will submit affidavits attesting to these facts:
   a. Must have applied for and received certification that the system and all components are approved per the requirements of NSF/ANSI Standards 61 and 372.
   b. Must have at least 5 years of experience successfully supplying both adsorption systems and GAC to treat water with flow rates greater than 500 gpm average daily flow.
   c. Must own and operate an equipment fabrication facility with capabilities to both fabricate the equipment per applicable ASME code and finish lining and paint in a single facility. In addition, this facility must be certified per the requirements of NSF/ANSI Standard 61.
   d. Must own and operate at least two (2) GAC production facilities in the United States to guarantee the source of supply of activated carbon (if carbon is selected).

1.05 Submittals

A. One submittal package with the following information will be provided for approval by the Owner. Fabrication will begin upon receipt of Owner's approval.
   a. Adsorber vessel specifications and drawing including design pressure, dimensions, and capacity.
   b. System flow diagram showing all valves, components, instrumentation, and utilities.
   c. System general arrangement showing dimensions, weights, and elevations including influent, effluent, backwash, and media exchange pipe connection locations.
   d. Pressure drop information across the system.
   e. Specification of the media to be utilized in the system.
   f. Material specifications for pipe, fittings, and instrumentation.
   g. Specifications for vessel lining.
   h. Specifications for vessel painting.

B. The system Operating & Maintenance Manual will be provided upon completion of the project/shipment of the system.

PART 2 Products

2.01 General

A. The Contract Documents indicate specific required features of the equipment, but do not purport to cover all details of design and construction.

2.02 Adsorber Vessels

A. The adsorption vessels are to meet the following specifications:

B. The adsorber vessels are fabricated of carbon steel, conforming to ASTM A516 grade 70, 12'-0" diameter by 16'-0" straight side height with 2:1 elliptical top and bottom heads. Each vessel will be sized to contain 40,000 pounds of GAC and to accommodate approximately 30% bed expansion within the straight side of the vessel using Filtrasorb 400 GAC or approved equal. The vessels are designed, constructed, and stamped in accordance with ASME Section VIII, Division 1 and registered with the National Board for a design pressure rating of 125 psig at 140°F. Each vessel will be provided with one (1) 20" diameter round manway located on the lower straight side portion of the vessel and one 14" x18" elliptical manway located on the bottom head. The vessels will be free standing utilizing four (4) structural steel support legs. The vessel will be provided with four (4) lift lugs located on the top head and one tailing lug on the bottom head.

C. The structural aspects of the vessel will be sufficient to meet the requirements of the International Building Code, latest edition. Detailed calculations shall be submitted on request illustrating the seismic characteristics of the proposed vessel.

D. Each vessel will be designed with an internal 30° cone bottom underdrain system that provides uniform distribution of the treated water using a minimum of one (1) septa for every nominal square foot of vessel cross section, facilitates media removal without the need to open the manway to manually hose out the remaining spent media, and allows replacement of the septa without the need to remove external piping. The septa will be designed to contain the media within the adsorber and be constructed of stainless steel.

E. The vessel will be provided with the following nozzles:
   a. One (1) 6" nozzle on the upper sidewall of the vessel for media fill.
   b. Two (2) nozzles for media discharge. One (1) 6" media discharge nozzle is located on the vessel side wall and one (1) 4" centered on the bottom head.
   c. One (1) 8" influent nozzle located on the top head constructed of stainless steel and provided with an internal flange to support the inlet distributor.
   d. One (1) 8" effluent nozzle located on the bottom head.
   e. Three (3) 2" sample nozzles located on the side wall.
   f. One (1) 2" cone vent nozzle located on the lower side wall

F. All surfaces will be degreased prior to sandblasting. The adsorber internal surface that will be lined will be blasted to a white metal finish (SSPC-SP5) to provide a 3 to 4 mil anchor pattern. The exterior surfaces of the adsorber will be prepared by blasting per SSPC-SP6.

G. The interior surfaces of the vessel will be lined as follows: he surfaces above the internal cone with a nominal lining thickness of 35 to 45 mil dry film thickness (dft) and the surfaces under the internal cone bottom a nominal lining thickness of 20 to 25 mil dft. The lining material meets the requirements of ANSI 61 when applied and cured per the manufacturer's requirements. The lining material will be one of the following:
   a. Carboline's Plasite 4110, vinyl ester lining
   b. Blome International's TL-220S AR, vinyl ester lining
   c. Carboline's Reactamine 760, aromatic polyurethane hybrid
   d. Or approved equal

H. The exterior surface of the adsorbers will be painted to a dry film thickness of 10 to 14 mil with a high solids epoxy (gray color) paint and finished with a polyurethane topcoat of 2 to 3 mil dft.

2.03 Process and Utility Piping

A. The process and utility piping on the adsorption system will include influent water to the system, treated water (effluent), backwash water supply and discharge, adsorber vent lines and media fill and discharge piping.

B. The influent and effluent pipe network allows series (lead/lag) and parallel only operating modes. Lead/lag operation allows either; a) flow from the influent flange to Adsorber A, to the pipe module, to Adsorber B, to the pipe module then to the effluent flange, or b) flow from the influent flange, to Adsorber B, to the pipe module, to Adsorber A, to the pipe module then to the effluent flange. The change in flow pattern is accomplished with a change of valve positions. The purpose of lead/lag operation allows an adsorber to act as an on-line backup and/or provides for sufficient contact time to allow adsorption of the contaminants of concern.

C. Process piping (influent, effluent and backwash) will be 8" diameter, constructed of schedule 40 carbon steel, ASTM A53 Grade B materials with 125# ASTM A126 Class B cast iron flanged fittings.

D. Vent piping will be 3" diameter, constructed of schedule 40 carbon steel, ASTM A53 Grade B materials.

E. Media fill piping will be 4" diameter, constructed of schedule 40 carbon steel, ASTM A53 Grade B materials. The connection at the vessel side wall will be a 4"x 6" reducing elbow. The

media fill connection will be supplied with an adjustable stainless-steel insert. There is a total of one (1) media fill line per vessel.

F. Media discharge piping will be 4" diameter, constructed of schedule 40 polypropylene lined carbon steel, ASTM 53 Grade B materials with ppl lined flanged fittings. There are a total of two (2) media discharge lines per vessel. The connection at the vessel side wall will include a 4"x 6" reducing elbow. The media side wall discharge connection will be supplied with an adjustable stainless-steel insert.

G. The vessel must be designed with an adjustable media removal system to allow for removal of the spent in 20,000 lbs. increments.

H. Utility piping will be constructed of threaded schedule 80 carbon steel, ASTM 53 Grade B materials.

I. All piping surfaces will be prepared by blasting per SSPC-SP7.

J. The exterior surface of the piping will be painted to a dry film thickness of 10 to 14 mil with high solids epoxy paint prior to assembly to minimize oxidation at flanged connections, then finished with a polyurethane topcoat of 2 to 3 mil dft after assembly.

K. The piping network will be provided with a structural steel support frame for support of the piping module.

2.04 Process and Utility Valves

A. The process and utility piping; excluding media fill and discharge piping will be equipped with butterfly valves to direct flow. A total of ten (10) 8" diameter butterfly valves will be supplied to accommodate the process and backwash functions. Two (2) valves are needed for backwash supply, two (2) valves are needed for influent isolation, two (2) valves for effluent isolation, two (2) valves for staging of the vessels and two (2) valves for the vent function.

B. The influent, effluent, and backwash valves will be a cast iron wafer type body butterfly valve with aluminum-bronze disc, BUNA-N seats, and stainless-steel shaft to mate to 150-pound ANSI flanges. The valves are rated for 200 psig in closed position at 180°F and meet or exceed section 5.0 of AWWA specification C-504-87.

C. The media fill and discharge valves are 4" diameter full port ball valves, 316 stainless steel construction with TFE seats and seals. A total of four (4) valves are supplied, two (2) for media fill and two (2) for media discharge.

D. Utility valves for the compressed air supply will be bronze or brass or barstock brass body regular port ball valves.

2.05 Instrumentation

A. Instrumentation will be accessible from grade.

B. Pressure relief will be provided by a 3" rupture disk constructed of impervious graphite and designed to relieve pressure at the design pressure of the vessel and at the maximum flow to the system. The rupture disks will be mounted off the vessel vent line and vent to atmosphere. A total of two (2) will be provided for the system.

C. Each vessel will be provided with an indicating differential pressure switch, 4" diameter dial, scaled for 20-0-20psi. The switch is rated at 1.0 amp @ 115 volts AC for remote indication. A total of two (2) will be provided for the system.

D. The process piping will be equipped with pressure gauges to indicate the pressure entering and exiting each adsorber and to provide information on pressure drop across each adsorber and the system. The pressure gauges will have 4 ½" face diameter with a stainless-steel bourdon tube in a phenolic case housing (1 to 160 psig range). A total of three (3) will be provided for the system.

E. The process piping will be equipped with sample taps to enable sampling of the water entering and exiting each adsorber. A total of three (3) will be provided for the system.

2.06 Miscellaneous

A. The media fill and discharge will be fitted with female hose connections, such that media transfer to and from the adsorbers can be facilitated using media transfer hoses. These connectors will be 4" Quick Disconnect Adaptors constructed of aluminum as manufactured by Dover Corp. as Kamlock connectors or equal.

B. Two (2) flush connections will be provided on each media fill line, one upstream and one downstream of the valve. One (1) flush connection will be provided on each media discharge line, downstream of the valve. The connections will be welded into the steel or stainless-steel pipe or screwed into solid propylene "spacers" for the lined pipe. Flush connections will consist of a short section of ¾" pipe, a ¾" full port ball valve and a ¾" quick disconnect adaptor to match with water hose fittings.

C. Each vessel will be provided with one (1) 8" stainless steel effluent strainer basket mounted in the effluent line from the vessel. The basket strainer shall be constructed of 316 stainless 14 gage plate with 1/8" diameter holes drilled on 3/16" centers, covered with 40 mesh 316 stainless steel screen and topped by a 4 mesh 316 stainless steel support screen (0.063" wire diameter). A total of two (2) will be provided for the system.

D. The influent and effluent pipe for each vessel will be provided with a molded neoprene reinforced rubber expansion joint which allows 4-way movement and 19° angular misalignment. A total of four (4) will be provided for the system.

E. Each vessel will be provided with an inlet distributor constructed of 316 stainless steel. The distributor will connect to the inlet nozzle and be fitted with multiple arms. Each arm is drilled along its length to facilitate even distribution of water during normal operation and collection of backwash water. A total of two (2) distributors will be provided for the system.

F. In-Bed Sample Taps: Each adsorber will be provided with three (3) 2" side sample nozzles for use with in-bed water sample probes. Sample probes consist of a 12" stainless steel pipe with a stainless-steel slotted septum to collect a water sample from within the media bed. The sample probe will be inserted through a 2" flanged nozzle and will be provided with stainless steel tubing drop line and stainless-steel shutoff valve external to the adsorber. A total of six (6) in-bed sample taps will be provided for the system.

G. Air/Vacuum Release Valve – Option Adder: Each adsorber can be provided with one (1) 1" combination air/vacuum release valve mounted at the top of the influent pipe. Two (2) 1" ball valves will be provided to isolate the air release valve, one ball valve positioned between the influent pipe and the air release valve and the second mounted at the bottom of the air release piping (at ground level). A total of two (2) will be provided for the system.

H. Each system will be provided with one Carbon Acceptance Canister (unless ion exchange resin is used). This will allow for testing of the carbon to determine its suitability for reactivation or disposal.

2.07 Granular Activated Carbon

A. GAC MEDIA INCLUDED AS ALLOWANCE PER THE BID FORM AND SECTION 01210. MEDIA WILL BE SELECTED BY OWNER/ENGINEER POST BID.

PART 3 Execution

3.01 Manufacturer's Services

A. The manufacturer will assign a Project Manager (PM) to facilitate the execution of the project. The PM will interface with the customer for both the technical and commercial aspects of the project.

B. The manufacturer will provide an Engineering Submittal Package as outlined in paragraph 1.05A.

C. The manufacturer will supply Operation and Maintenance Instructions upon completion of the project/shipment of the system.

D. A manufacturer's trained specialists, experienced in the installation of the GAC Systems, and with at least five (5) years of field experience will be present at the job site and/or classroom designated by the Owner/Contractor to provide the following services:

- Inspection of the installed equipment
- Supervision of media loading
- Start-up assistance
- Troubleshooting
- Operator training

E. The manufacturer will retain design and fabrication documentation for a minimum period of seven (7) years following completion of the project.

3.02 Services By Contractor

A. The site or designated contractor will be responsible for installation and site services, typically including:

1. Site preparation, foundation design and foundation installation
2. Receipt, off-loading (and storage) of adsorption system equipment
3. Installation of adsorption system equipment
4. Connection of the dP switch to an alarm system
5. Provision of a means to keep the vessel flooded in all operating modes
6. Any hydrostatic test of the installed (assembled) system at the site
7. System connection to existing infrastructure
8. System disinfection prior to initial fill of media
9. Utilities for bulk loading of media (compressed air, clean water source, backwash water disposal)
10. Operation of the system during media fill operation
11. Mechanical startup of the system

SECTION 11520

ON-SITE MIXED OXIDANT GENERATION SYSTEM

PART 1 GENERAL

1.1 SCOPE OF WORK

A. This Section covers the work necessary by the General Contractor, Installation Contractor, On-Site Generation Mixed Oxidant System (OSGMOS) Supplier, Owner and Engineer, to furnish, install, test and prepare for operation an On-site Generation Mixed Oxidant System. The OSMOS package includes what is listed in paragraph B below as well as related testing, start-up and training services.

B. An On-Site Generation Mixed Oxidant System (OSGMOS) shall be furnished to enable on-site production of a 0.45% (4,500ppm) (+/- 1,000) Mixed Oxidant solution through the electrolysis of brine. The total installed generation capacity of the OSGMOS System shall be 600 pounds of free available chlorine (FAC) per day. Each generator will have a capacity of 300 pounds of FAC per day. Each generator shall be able to be expanded within the existing enclosure by 60 pounds of FAC per day up to a maximum capacity of 300 pounds FAC per day.

C. The OSGMOS System Supplier shall furnish the following components:

1. Generator Skid
    a. Powder coated aluminum frame
    b. Programmable Logic Controller (PLC) and associated components
    c. Human Machine Interface (HMI)
    d. Network communication capability
    e. Transformer/Rectifier
    f. Electrolytic Cell
    g. Liquid flow control components
    h. Brine proportioning pump
    i. Internal process required instrumentation
    j. Assembly piping, valves and safety devices
    k. Rotomolded HDPE cover panels
2. Water filter(s) and accessories
3. Water Softener(s) and accessories
4. Water Heater and accessories
5. Salt/Brine Storage Tank(s) and accessories
6. Mixed Oxidant Solution Storage Tank(s) including:
    a. Level control(s) and accessories
    b. Passive Liquid Barrier Hydrogen Venting System (LBS)
7. Mixed Oxidant Dosing System consisting of:
    a. Metering pump(s) with motor(s) and associated motor control (VFD or other)
    b. Pump accessories (ex: Isolation valves, BPV, PRV, calibration column)
8. Field Instrumentation including:
    a. Hydrogen Detector

b. Hardness Monitor

9. OSGMOS spare parts kit, metering pump spare parts kits and maintenance kit

D. The OSGMOS System Supplier shall submit shop drawings and data sheets for all major OSGMOS System supplied equipment. The Shop Drawings and data sheets shall be submitted to the General Contractor for approval.

E. The OSGMOS System Supplier shall be responsible for programming the OSGMOS package control software. The Engineer shall provide criteria for the interface of the OSGMOS PLC with the plant wide PLC's. These criteria are Ethernate/IP communications with signals as indicated in the SCADA I/O table on the Drawings.

F. Programming of the OSGMOS package control software shall not include Mixed Oxidant dosing controls. Mixed Oxidant dosing shall be controlled by Plant's SCADA via 4-20 mA signal.

G. The OSGMOS Supplier shall submit two hard copies and one (1) electronic copy.

H. The Installation Contractor shall install the OSGMOS System, as defined in this specification and in accordance with the OSGMOS System Supplier's submitted and approved shop drawings. The Installation Contractor shall be responsible for providing and installing interconnecting piping, valves, conduits, cable glands, wiring, cable trays, all supports and associated hardware and anchor hardware to the OSGMOS System Supplier's equipment and its ancillaries including piping, valves, supports and hardware from the hypochlorite metering pumps to the injection points to provide a complete and fully operational OSGMOS System.

I. For proper integration and operation of the chemical dosing system, the Engineer shall be responsible for the design of the chemical dosing system which includes the selection of metering pump(s), piping system from dosing metering pump(s) discharge to injection point(s), piping supports, selecting the location of the injection point(s) and sampling point(s) and defining the chemical dosing control strategy. Dosing shall be controlled by Plant's SCADA.

J. After the installation is complete, the Installation Contractor shall provide the OSGMOS System Supplier with detail digital pictures of the installation from the start to end of the process as shown on the approved P&ID and a copy of the completed pre-startup checklist for a courtesy inspection review. The OSHGS Supplier shall review and provide recommendation if corrections are needed to ensure compliance with the approved submittals. Only after all necessary corrections are completed, the OSGMOS System Supplier shall schedule a technician for start-up and training.

K. The OSGMOS System Supplier shall perform start-up testing of the OSGMOS system in accordance with the contract documents.

L. The OSGMOS System Supplier shall train the Owner's personnel and provide instructions about the operation and maintenance of the OSGMOS System.

1.2 GENERAL

A. All electrical, mechanical, metal, painting and instrumentation work included herein shall conform to the applicable Sections of this specification except as otherwise shown or specified.

B. The General Contractor in collaboration with the Engineer shall identify and provide a detailed list of all applicable specification's divisions and sections to allow the OSGMOS System Supplier to execute the contract within a defined scope and schedule.

C. The OSGMOS skid shall be shipped as one self-contained unit with all factory installed piping to input and output connections located at accessible points on the skid and with all factory wiring as shown on approved P&ID.

D. Power shall be provided by the General Contractor as shown on the OSGMOS System supplier's approved shop drawings. The General Contractor shall be responsible for providing all conduit and wiring necessary for a complete electrical service to the site location. All wiring shall comply with the latest edition of the National Electrical Code, and local codes.

E. The contract documents shall clearly specify requirements for OSGMOS System Supplier to provide a complete and workable system.

1.3 SUBMITTALS

A. Shop Drawings – The OSGMOS System Supplier shall submit One (1) electronic set of the documents listed below to the General Contractor and the Engineer for approval.

1. Manufacturer/Supplier's literature, illustrations and specifications for the major components. The literature shall include detailed descriptions and specifications of the component to permit comparison with the technical specifications.
2. Equipment dimensions, materials, size and weight: Equipment anchor bolts layout but not including anchor bolts size, length, material and embedment.
3. Equipment general arrangement drawings with dimensions and locations of inlet and outlet connections.
4. Electrical documentation shall include panel layouts, schematics, and interconnecting field wiring diagrams. Ethernet/IP tag and alarm lists shall also be submitted for interface with SCADA.
5. Hydrogen dilution blower data sheet and performance curve.
6. For each supplied pump, a pump data sheet indicating head, capacity and horsepower as applicable shall be provided.
7. Piping and Instrumentation Diagram.
8. Design Operating Specifications including acceptable range of water pressure, water and brine flow rates, water temperature, and water quality (hardness, pH, heavy metals, TOC, etc.) to On-Site Electrolyzer(s) for proper system operation.
9. Evidence of compliance to NSF/ANSI 61 listing.

B. The OSGMOS System Supplier shall submit One (1) electronic final copy and One (1) paper final copy of the Operation and Maintenance manual as described below to the General Contractor and Engineer for approval:

1. Installation and operating instructions for each major piece of equipment.
2. Explanations for all safety considerations related to operations.
3. Startup Procedures.
4. Delivery, Handling and Short & Long-Term Storage Instructions.
5. As-built drawings.
6. OSGMOS System Building Installation and Design Consideration Guidelines.

7. Maintenance Procedures shall include proper instructions required by plant personnel to keep equipment properly cleaned, lubricated and adjusted to manufacturer's specifications. The following shall be provided:

    a. Preventative Maintenance Schedule Checklist

    b. Troubleshooting guide (instructions)

    c. Basic Testing Guide

    d. Acid Wash Guide

    e. Recommended spare parts list

1.4 QUALITY ASSURANCE

A. OSGMOS Supplier's Qualifications

1. The OSGMOS Supplier shall have experience in furnishing equipment of similar capacity and service capability to the equipment described herein. As part of their submittal package and prior to bid, the OSGMOS supplier shall submit the following:

    a. A list of five (5) installations, within Kentucky where similar equipment by the manufacturer is currently in comparable service; include contact name, telephone number, mailing address of the site installation, engineer, owner and date of installation. If five similar installations do not exist in that state, a comprehensive list of all installations in that state shall be provided in addition to a list of ten (10) similar installations in other states.

    b. Current NSF/ANSI 61 listing for the Mixed Oxidant generation unit being offered.

    c. Engineering Design Consideration Guidelines.

    d. Current ISO 9001:2015 Certification applicable to Design, Manufacture, assembly, installation, service and repair of Electrochlorination Systems for Water and Sewage Treatment and Water Treatment equipment.

2. The generation skid shall be pre-assembled, and factory tested in accordance with section 1.4-B below.

B. Factory Acceptance Test (FAT)

1. The OSGMOS System Supplier shall test pre-plumbed assemblies, control panels and junction boxes prior to shipment.

    a. The test shall consist of the following:

        1) Visual inspection of general workmanship.
        2) Visual verification that the arrangement and dimensions of the assembly matches the fabrication and schematic drawings.
        3) Visual verification of nameplates information.
        4) Hydrostatic Leak test. The OSGMOS System Supplier shall perform a hydrostatic leak test on the OSGMOS Skid assembly by filling the unit with water, venting all air, and pressurizing the entire system to 30 psig and holding it for 15 minutes.
        5) Continuity test to verify wiring.
        6) Simulation of I/O's to verify correct wiring and correct software.
        7) Measure the concentration of Mixed Oxidant solution (as chlorine equivalent) generated by the OSGMOS unit.
        8) Confirm and document all instruments' set-points, system alarms and faults as shown on the electrical control panel drawings and control philosophy
        9) Document all test data on a Test Record Form.

1.5 DELIVERY, STORAGE AND HANDLING

A. During long-term storage or long shut-down period, the General Contractor shall be responsible for periodically preserving and maintaining each piece of equipment of the OSGMOS System and re-conditioning them prior to startup.

1.6 WARRANTY REQUIREMENTS

A. The OSGMOS Supplier shall inspect the installation after completion and confirm that the OSGMOS System's supplied equipment and installation is free from faults and defects and is in conformance with the OSGMOS Supplier's approved submittal drawings and documents.

1. The first inspection shall be a visual one using the digital pictures and pre-startup checklist completed by the Installation Contractor.

2. The second inspection shall be done before startup and shall be a visual site inspection of the mechanical and electrical installation of the OSGMOS Supplier's provided equipment only.

B. The OSGMOS Supplier shall provide the following After Market Services:

1. 24-hour, 365-day toll free service.

2. Standard parts availability.

C. The OSGMOS System shall be warranted against defects in materials and workmanship under normal use and service of which its products were designed as defined by the manufacturer's requirements.

1. The On-Site Generator skid warranty shall be for a period of 18 months after OSGMOS equipment start-up and commissioning sign-off by customer or 24 months from shipment of the goods from the factory, whichever comes first

2. The Electrolytic Cell warranty shall be for a period of 72 months from shipment of the goods from the factory. (2 year full and remaining 5 years pro-rated) The cell warranty covers the complete cell assembly, not just the electrodes. The warranty is valid only for properly maintained Electrolytic Cell assembly per the OSGMOS Supplier's operation and maintenance manual and maintenance logbook.

3. The On-Site Generator supplier shall warranty other equipment and services included in its scope of supply for the project for 12 months from shipment of the goods from the factory or with original equipment manufacturer's warranty, whichever comes first.

D. This warranty only includes parts and does not cover labor, expenses, consumable maintenance items, "Acts of God", theft and vandalism, intentional or accidental abuse, misuse, neglect or operator error, failure to perform preventative maintenance, abuse by abnormal system conditions, improper storage and long-term preservation, alteration of equipment/programming, and normal wear and tear.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. OSGMOS, MIOX® R-Series as manufactured by De Nora Water Technologies, LLC,

B. Chlorinsitu III Electrolysis System by Prominent Fluid Controls

C. CT-150 manufactured by ClorTec

D. Or approved equal.

2.2 GENERAL OSGMOS SYSTEM OPERATION AND DESIGN REQUIREMENTS

A. The Mixed Oxidant Generator shall require salt, water and electricity.

B. The Brine tank shall produce a saturated brine solution using softened water and salt.

C. The water softener resin shall be automatically regenerated with Brine solution from the Brine tank.

D. The Mixed Oxidant Generator skid shall be equipped with safety devices/instruments such as pressure, temperature and flow sensors in order to ensure a safe and reliable generation process.

E. A diluted brine solution shall pass through the electrolytic cell(s) located on the On-Site Generator unit and produce a consistent 0.45% (±1,000 mg/L) weight Chlorine equivalent as Mixed Oxidant solution.

F. Recirculation of the Mixed Oxidant solution shall not be allowed to avoid decomposition, reduced and inconsistent concentration of Mixed Oxidant, Hydrogen bubbles entrapment and increased hypochlorite solution temperature leading to increased concentration of by-products such as chlorate and perchlorate.

G. The generated Mixed Oxidant solution shall be stored in chemical resistant storage tank(s).

H. The Mixed Oxidant storage tank shall have a minimum of 24 hour(s) of storage capacity calculated based on 4,500 mg/L FAC nominal concentration.

I. The Mixed Oxidant storage tank(s) shall be equipped with level controls for operation of the generation equipment and alarm initiation. The OSGMOS shall automatically start and stop based on the high and low level in the Mixed Oxidant storage tank.

J. The OSGMOS shall have no waste products associated with its use other than hydrogen gas which shall be vented to atmosphere and softener backwash.

K. The hydrogen venting system shall be completely passive without any moving parts or active components. Piping shall be sized according to the DNWT Hydrogen Safety White Paper (HSWP).

L. Under normal operating conditions, the stored Mixed Oxidant solution shall be injected into the process at locations shown on the contract drawings for disinfection.

M. Under emergency conditions, if commercially available Sodium Hypochlorite (10–12 percent solution) is used, Bulk Hypo dilution system shall be provided.

N. The OSGMOS System package shall consist of the equipment listed in Section 1.01.C of this specification.

2.3 GENERAL OSGMOS SYSTEM DESIGN REQUIREMENTS

A. The Mixed Oxidant Generation System shall produce 300 (minimum) pounds per day of chlorine equivalent calculated based on 8,000 gallons per day of 4,500 mg/L (+/- 1,000) Mixed Oxidant through the electrolysis of brine.

B. The system shall include the following generator(s):

1. Capacity per generator skid: 300 lb/day
2. Total number of generator skid(s): Two (2)
3. Quantity of generator skid(s) running as Duty: One (1)
4. Quantity of generator skid(s) as Standby: One (1)

C. Water, brine or generated solution recirculation design shall not be allowed as it causes repeat breakdown and degradation of the generated solution strength, increase product temperature and increase by-product (such as chlorate and perchlorate) formation.

D. The Electrolytic Cell(s) shall be periodically cleaned In-Place for Safety of the operating/maintenance personnel. Removal of the electrolytic cell assembly from the hypochlorite generation system for periodic acid cleaning maintenance shall not be required.

E. The supply water quality and temperature shall be as follows.

1. Lowest water temperature: __37____ (degrees F) for ___60___ days per year
2. Highest water temperature: ____25___ (degrees F) for ____60___ days per year
3. Annual average water temperature: _____20__ (degrees F) for ____245___ days per year
4. Water quality analysis

F. Salt quality shall comply with the minimum requirements listed in the table below.

Sodium Chloride (NaCl) – Minimum Quality Requirement	
Sodium Chloride – dry basis	96.3% minimum
Sodium Chloride – wet	93.3% minimum
Calcium Sulfate	0.30% maximum
Magnesium Chloride	0.06% maximum
Calcium Chloride	0.10% maximum
Magnesium Sulfate	0.02% maximum
Insolubles	0.10% maximum
Moisture (as H_2O)	3.0% maximum
Lead	0.0007% maximum
Copper	0.0003% maximum
Iron (as Fe)	0.02% maximum
Fluoride	0.00001% maximum
Manganese	<0.0002%
Limit Aluminum, Silicon, Barium, Strontium, Titanium, Suspended Solids, Heavy	

Metals, Complexing Agents (i.e. Sugars, EDTA, and CN-)

G. Feed water quality shall comply with the minimum requirements listed in the table below.

Feed Water – Minimum Quality Requirement	
Temperature (Recommended)	55-80°F
pH	6.5 – 7.5 Recommended Up to 8.5 allowed
Hardness (Ca/Mg)	<1 gpg (<17.1 mg/L) Out of softening equipment
Total Organic Carbon (TOC)	<2 mg/L
Iron	<200 µg/L
Manganese	<10 µg/L
Nickel	<5 µg/L
Fluoride	< 1 mg/L
Copper	< 5 µg/L
Chlorine (Cl2)	<2 mg/L
Barium	<1 mg/L
Strontium	<10 mg/L
Polyphosphates	<5 mg/L
Magnesium	< 50 mg/L
Limit Aluminum, Silicon, Barium, Strontium, Titanium, Suspended Solids, Heavy Metals, Complexing Agents (i.e. Sugars, EDTA, and CN-)	

H. The Mixed Oxidant Generator shall shut down for the following conditions:

1. Common Critical Alarms
    a. Hydrogen Alarm
    b. Hardness Alarm
    c. Dilution Air System Alarm
2. OSGMOS Process Critical Alarms
    a. Cell High Temperature [Not to exceed 130 ºF (54.4 ºC)]
    b. Low Feed Water Temperature to the cell [40 ºF (4.4 ºC)]
    c. Power Supply Fault
    d. Low Feed Water Flow
    e. Low Feed Water Pressure

I. The On-Site Generator shall alarm for the common and critical alarms listed above including the following conditions:

1. Oxidant Level Transmitter Loop Fault
2. Power Supply Voltage & Current outside allowable operating range

J. The Oxidant storage tank level controls shall provide the following two (2) specific level conditions to the OSHGS control panel:

1. Generator Stop
2. Generator Start

2.4 GENERAL OSGMOS REQUIREMENTS

A. The Mixed Oxidant electrolytic cell is required to have the capability to reverse polarity in a self-cleaning cycle in order to decrease the frequency of manually acid washing the cell.

B. Each generator shall produce 300 (minimum) pounds per day of FAC at 4,500 mg/L (+/- 1,000) through the electrolysis of brine.

C. Each generator production capacity shall be achieved without exceeding the maximum raw material usages listed below.

1. The electrolytic cell shall consume a maximum of 2.5 pounds of salt per pound of chlorine equivalent output, using salt containing no organic binders, flow control agents or resin cleaning material, and meeting the following specifications listed under SECTION 2.2.
2. The electrolytic cell shall consume a maximum of 3.5 kilowatt-hours AC of electricity per pound of chlorine equivalent output.
3. The electrolytic cell shall consume a maximum of 26.7 gallons of water per pound of chlorine equivalent generated. The water supply to the softener shall be potable and free of polymer additives, flocculants, coagulants, anti-scalants, organics, oil & grease, and suspended solids and shall meet the following specifications listed under SECTION 2.2.

D. Each generator shall operate at 200 mA/cm2 (2 kA/m2) (1.29 A/in2) maximum.

E. Each generator shall receive a process stream of saturated brine.

1. The dilution of the concentrated brine will take place at each electrolytic cell through the use a of a variable speed brine pump.
2. Conductivity probes shall not be allowed.
3. Manual controlled brine feed to electrolytic cell shall not be allowed.
4. Common/shared brine dilution system for multiple OSHG unit shall not be allowed.

F. Each Generator shall receive a processed stream of dilution water.

1. Water hardness shall be no more than 17 mg/L.
2. The soft water feed shall be monitored using a pressure sensor and a flow meter.
3. Water flow shall be automatically controlled by the generator's PLC via a modulated flow control valve for each electrolytic cell.
4. Flow sensing shall be performed using a high-speed counting functionality with an accuracy within +/- 15%.
5. Manual water flow control shall not be allowed.

G. All electrolytic cell module(s) shall be plumbed and operated in a parallel flow arrangement. Electrolytic cells and/or modules installed in series shall not be allowed.

H. Recirculation of water and brine through individual and/or multiple cells shall not be allowed.

I. The Generator shall operate at constant capacity, and automatically start and stop based on the low and high liquid level setpoints in the Oxidant Storage Tank.

J. All OSGMOS functions performed by the generator control platform shall use PID loops where applicable.

K. At a minimum, the Generator shall have the following safety features:

1. Rupture disk with burst sensor on outlet of cell
2. Rupture Disk Fail
3. Flow switch on the feed water inlet
4. Pressure switch at the inlet to the cell
5. Cell - High Temperature
6. Cell - Low Flow
7. Cell - Very High Current
8. Power Supply - Low Voltage
9. Power Supply - Low and High Current
10. Automatic current regulation
11. Low Feed Water Temperature
12. Delta temperature fault
13. Very High Oxidant temperature

L. The above safety features shall be interlocked to prevent or alarm operation if any of the normal parameters are exceeded. In the event of a trip condition, an alarm contact set will be made signaling an alarm condition.

M. Generator Skid

1. The self-contained On-Site Mixed Oxidant Generator (OSGMOS) skid shall be factory pre-plumbed and pre-wired. The generator skid shall include all valves, piping and instrumentation necessary to dilute saturated brine before it enters the electrolytic cell.
2. The generator skid shall be configured to allow easy access to all components for ease of operation & maintenance and shall adhere to standard equipment height and reach requirements.
3. The generator skid shall be free standing, powder coated aluminum frame which will contain the generator's controls, transformer/rectifier, soft water/brine plumbing and electrolytic cell.
4. Each generator assembly dimensions shall be:
    a. Width: 61.9 in
    b. Depth: 46.2 in
    c. Height: 86.1 in
5. The skid shall be split in five (5) internal compartment, isolated from each other. These compartments will include:
    a. Controls compartment where the PLC and HMI are located. This compartment will only have 24VDC power available for safety.

b. Switchgear compartment where the skid 3-phase power is received and distributed to other electrical equipment/compartments. It is also where the 24VDC power supply is located.

c. Transformer/Rectifier section which includes the transformer, the rectification components and the air-cooling blower for the transformer.

d. Plumbing compartment which include all the soft water and brine fittings and accessories.

e. Electrolytic cell compartment which includes the cell and its associated plumbing and sensors.

6. Each compartment shall be isolated from each other and in the case of the ones which includes wetted components, shall include a dripping pan with associated drain line.

7. All inter-enclosure wirings shall be pre-wired and tested at the factory.

N. Integral Transformer/Rectifier (Power Supply)

1. Each generator shall have its own dedicated transformer/rectifier, pre-installed on the skid.

2. It shall be air-cooled. Water or oil cooled transformer/rectifier shall not be allowed.

3. It shall be mounted as a pre-assembled bloc for ease of access, maintenance and/or replacement as needed.

4. It shall function to provide constant current to the cell within the specified voltage ranges.

5. It shall be controlled by the OSGMOS internal PLC. All monitored/controlled information related to the transformer/rectifier shall be available on the OSGMOS Human Machine Interface (HMI).

O. Integral Control System

1. Each OSGMOS unit shall have dedicated controls, pre-installed within the skid.

2. The control panel shall house the Human Machine Interface (HMI), Programmable Logic Controller (PLC), memory card, Ethernet hub for communication and associated components and terminal strips for field devices to fully support the functions of the OSGMOS operation.

3. The PLC shall be Allen Bradley CompactLogix 5380/5069 Programmable Logic Controller (PLC) with Ethernet Ports/Protocols, built-in I/Os, memory for application updates and data logging capabilities.

4. The HMI shall be an Allen Bradley PanelView 7" TFT Color Touch-Screen (or approved equal) to show all relevant operating parameters and/or alarm conditions.

5. All controls and operation logic to control the OSGMOS internal components and select related peripherals specified herein shall be programmed in the PLC. The control panel logic shall function at the PLC level where operating parameters will be scaled, measured and controlled.

6. At a minimum, each OSGMOS shall have the following Alarms and Status:

a. Master Switch Off – Status

b. Power Supply Thermal Switch – Status

c. Oxidant Tank Level Low – Status

d. Oxidant Tank Level High – Status

e. Low Water Flow – Alarm

f. Inlet Water Pressure Low – Alarm

g. High Oxidant Temperature – Alarm

h. High Power Supply Temperature – Alarm

i. Low Cell Current – Alarm

j. High Cell Current – Alarm

k. Low Cell Voltage – Alarm

l. Very High Cell Current – Alarm

m. Low Brine Pump Voltage – Alarm

n. Low Feed Water Temperature – Alarm

o. High Feed Water Temperature – Alarm

p. High Oxidant Shutdown Temperature – Alarm

7. Control system shall have, but not be limited to, the following I/O:

   a. Inputs

      1) Dry contact - Oxidant Tank Level Low
      2) Dry contact - Oxidant Tank Level High
      3) Dry contact - Hydrogen Monitor Alarm
      4) Dry contact - Hardness Monitor Alarm
      5) Dry contact - Dilution Air Flow Switch Alarm

   b. Outputs

      1) Auxiliary Dilution Air System – 24VDC Run signal
      2) Dry contact water boost pump relay
      3) Dry contact brine boost pump relay
      4) Dry contact general alarm output relay

8. External control panel shall not be allowed to control a single generator.

9. All controls and operation logic for the chemical dosing system shall be supported by Plant's SCADA.

10. The Installation Contractor shall coordinate with the OSGMOS System Supplier and Instrumentation Supplier for proper system/SCADA integration.

11. The control panel shall be equipped with all provisions to facilitate Remote System monitoring and troubleshooting for multiple operators' access.

P. Electrolytic Cell

1. The electrolytic cell shall be located within the OSGMOS skid assembly. Remote cell(s) and/or rack(s) shall not be allowed.

2. The electrolytic cell casing shall be constructed of high quality-CPVC material, which has superior chemical and temperature compatibilities with generated chlorine based oxidant solution.

3. The electrolytic cell shall be mounted in such a way to prevent pure horizontal or vertical flow through it in order to maximize the use of the electrode available active surface. No pure vertically oriented cells shall be allowed.

4. The electrolytic cell shall be mounted for clear and easy access.

5. Cell construction shall be rectangular to minimize gas head space inside of the electrolytic cell, and modular allowing electrodes to be removed as a single assembly.
6. Any necessary joining of electrolytic cell materials shall be by solvent welding or mechanical compression. Thermal welding will not be allowed.
7. The electrodes shall be Titanium and the anodes coated with a mixed metal oxide catalytic coating for electrical efficiency and maximum longevity. The electrodes shall be solid flat plate and shall be constructed in a bipolar configuration to facilitate current distribution and minimize voltage drop through the electrodes.
8. The electrolytic cell shall be of modular design with a total of one (1) inlet and one (1) outlet regardless if the electrolytic cell is composed of a single module or multiple modules. Multiple cells design will not be allowed.
9. The electrolytic cell shall generate a solution of Mixed Oxidant below 120 ºF (49 ºC).
10. The electrolytic cell shall be able to reverse polarity in a self-cleaning cycle in order to decrease the frequency of manually acid washing the electrolytic cell. A high velocity recirculation loop that creates a scouring action or automatic chemical feed system is not an acceptable substitute for a self-cleaning electrolytic cell.

2.5 HYDROGEN MITIGATION

A. PASSIVE LIQUID BARRIER SYSTEM (LBS)

1. The EQUIPMENT SUPPLIER shall provide a liquid barrier system (LBS). No systems requiring dilution air blower(s) will be accepted.
2. On-Site generated solution will flow into through pipes and fittings and into an internal tank mounted Liquid Barrier Vent drop tube assembly located inside the oxidant product tank(s).
    a. Each storage tank shall be equipped with an LBS assembly.
    b. The drop-tube assembly shall extend to within 1” of the bottom of each oxidant tank.
    c. The drop tube diameter shall be six (6) inches to ensure that the bubble rise velocity is significantly greater than the downward liquid flow velocity, thereby ensuring that hydrogen is force vented to the top of the drop tube and out of the hydrogen vent plumbing.
    d. The hydrogen vent plumbing will be connected to a tee fitting immediately on the exterior of the oxidant tank extending upward and plumbed to exterior of the facility.
    e. Each tank generated solution inlet through-wall Liquid Barrier System (LBS) adapter shall be CPVC Schedule 80 material with a minimum of four (4) inch diameter.
    f. Each tank generated solution LBS inlet vent tee shall be CPVC Schedule 80 material with a minimum of four (4) inch diameter, to be vented to outside of building.
    g. Each tank secondary vent adapter shall be CPVC Schedule 80 material with a minimum of four (4) inch diameter, to be vented to outside of building.
    h. Connecting/combining vent piping together shall be strictly prohibited.
    i. The proposed system shall be submitted for approval by the ENGINEER.

2.6 WATER FILTER

A. The EQUIPMENT SUPPLIER shall provide two (2) feed water filter with wall bracket adapter. If multiple filters are provided, installation shall be in a parallel arrangement to allow for all filters to operate at the same time.

B. Filter housing shall be
   1. Pentek Products Filter Housing or approved equal
   2. Big Blue, 20" Long
   3. Integrated pressure relief valve
   4. 1-½" FPT inlet/outlet connection

C. Filter cartridge shall be
   1. 5-micron
   2. Pleated disposable cartridge

D. Two (2) pressure gauges shall measure pressure drop across filter assembly.
   1. Pressure gauge shall be
      a. WIKA copper allow Bourdon tube or equal
      b. Polycarbonate window
      c. Glycerin Filled
      d. ¼" NPT connection
      e. 0-100 PSI range

E. Each filter shall have Two (2) isolation valves
   1. Spears true union standard ball valves or equal
   2. 1½" NPT
   3. Viton seal

2.7 GAC FILTER

A. The EQUIPMENT SUPPLIER shall provide a GAC Filter for removal of sediment. TOC and chlorine to condition makeup water to the on-site generator prior to the water softener as specified in 2.8.

B. The unit will be a multi-tank system design which provides supply of clean, filtered water to the softener. The unit has a backwash cycle which uses treated water to enhance cleaning results, improve water quality and extend media life

C. The unit will be provided with valves and tanks which are made of non-metallic, corrosion-resistant materials to prolong system life and enable the system to endure harsh environments.

D. The GAC filter shall be a KineticoPRO's CP Series GAC Filter

2.8 WATER SOFTENER

E. The EQUIPMENT SUPPLIER shall provide a water softening system for use in generating the oxidant solution using one set of twin tank ion exchange water softeners with a hydraulically-driven, flow-controlled switchover valve. When the ion exchange capacity of duty resin tank is nearly exhausted, the softener control mechanism will automatically divert flow to the standby tank while initiating a brine backwashing of the first tank for regeneration of the ion exchange resin. Minimum efficiency will be 3,800 grains exchange per pound of salt.

F. Capacity of the softeners shall be appropriate for continuous use with water of the following quality:

1. Water Pressure (min – max): 15 to 125 PSI
2. Water Temperature (min – max): 35 to 120 °F
3. Water pH (min – max): 5 to 10
4. Water Hardness mg/L as CaCO3: 170 mg/L Max
5. Chlorine Residual: 2 mg/L Max

G. Connections associated with each water softener will include

1. Inlet Outlet pipe fittings connection: 1¼ - in
2. Brine regeneration connection: 3/8 - in HDPE tube with in-line check valve
3. Backwash drain connection: 5/8 - in HDPE tube

H. The regeneration process and frequency will be accomplished by the water supply hydraulic pressure, no electric power required. Regeneration shall be based on total volume of water flow since the last regeneration cycle rather than on a fixed time interval.

I. Each softener shall use brine from the saturator tank for the regeneration cycle. The regeneration waste shall be disposed to a sanitary drain.

J. The water softener shall be located no more than 15 feet away and at no more than 8 feet elevation above the Brine Tank. Otherwise, a brine boosting system or auxiliary brine day tank with level controls and a transfer pump shall be provided.

K. The water softener shall be a highly efficient, automatic regeneration design as manufactured by Kinetico Corporation (CP-216s) or approved equal.

2.9 WATER HEATER

A. Incoming water supply temperature shall be as follows.

1. Lowest water temperature: ____37___ (degrees F) .
2. Annual average water temperature: ___68____ (degrees F)

B. The EQUIPMENT SUPPLIER shall provide one (1) industrial grade, wall mounted instantaneous electric water heater unit(s) as indicated on the drawings to heat soft water entering the water/brine flow panel to above 55 °F.

C. The entire unit shall be packaged ready for plumbing and electrical service connections and shall bear the cULus listing mark certifying the entire unit to UL499, UL EPH Sanitation listed to ANSI/NSF Standard 5 and CSA C22.2 No. 64-M91.

D. The immersion heating elements shall be high quality incoloy sheathed and sized to obtain the rated capacity.

E. Each element is to be operated using zero cross over solid-state controls.

F. The heating elements shall be fully modulated from 0-100% to provide precise temperature control through the full range of flows.

G. A Hi-Limit thermostat with automatic reset shall be factory installed to disconnect each heating element in the event of an over-temperature condition.

H. An electronic digital display temperature controller shall be user adjustable in 1° increments in either °F or °C and shall display flow rate, outlet temperature, inlet temperature and provide error indication.

I. A turbine-type flow meter shall be factory installed to provide precise temperature control for inlet water flows

   a. For low flow range, flow meter range shall be from 0.2 GPM up to a maximum flow of 8 GPM. Heaters that require greater than 0.2 GPM flow for actuation or restrict flow shall not be acceptable.

   b. For high flow range, flow meter range shall be from 0.5 GPM up to a maximum flow of 40 GPM. Heaters that require greater than 0.5 GPM flow for actuation or restrict flow shall not be acceptable.

J. The heating chamber shall be all Sil-brazed copper and bronze construction. A plastic heating chamber shall not be acceptable. Water heater heating chamber shall be rated for a maximum allowable working pressure of 150psi. The heating chamber and all electrical controls shall be completely enclosed in a heavy gauge Type 304 stainless steel case.

K. Each heater unit shall be properly sized for the soft water flow required by each electrolyzer train.

L. Each Heater shall have the following minimum capacity:

1.	Flow:	1,125 GPH
2.	Temperature (from):	___37___ °F
3.	Temperature (to):	___65___ °F
4.	Heater Temperature Delta:	28 °F

M. The water heater shall be powered directly from the plant electrical system.

N. Water Heater shall be Hubbell Electric Heater Co. or approved equal.

2.10 BRINE TANK

A. The EQUIPMENT SUPPLIER shall furnish a bulk salt storage brine making system in accordance with the Drawings and the following specifications.

B. The EQUIPMENT SUPPLIER shall provide flat bottom, upright, dome top tank(s) suitable for the storage of salt and brine solution.

1.	Number of tank(s):	1
2.	Storage Capacity (each tank)	25 Ton (50,000 lb of salt)
3.	FAC Demand (#/day)	50#/day (average)/175#/day (peak)
4.	Salt Usage (#/day)	125 #/day (average)/437.5 #/day (peak)
5.	Minimum days of storage capacity	400 days (average)/114 days (peak) total
6.	Diameter (maximum):	122 inches each
7.	Height (Shell):	123 inches each

8. Height (overall): 150 inches each

C. The salt brine process vessel shall be constructed of fiberglass reinforced plastic (FRP). Resin shall be Aropol 7241T-15 by Ashland or approved equal. All nozzles shall have insulation replaced around lay-up areas.

D. The vessel shall be NSF-61 approved when applicable or required by the application.

E. The brine tank shall be designed to accept salt by pneumatic transfer.

F. Each Brine tank shall be provided with the following connections and accessories:

1. Four tie-down lugs and four lifting channels made of stainless steel.
2. One 4 inch conically gusseted flanged nozzle with a 4-inch diameter 304 stainless steel salt unloading pipe and a 4-inch aluminum camlock coupling and cap. A ¾ inch water injection port shall be welded close to the inlet of the 4 inch salt pipe and a ¾ inch (5 gpm) flow regulator shall be installed on the injection port. The 4 inch salt fill line shall be supported off the tank wall.
3. Brine outlet conically gusseted flanged nozzle with:

   An internal brine plenum with slotted PVC pipe and layers of fiberglass screen to be used in conjunction with a quartz rocks filter bed
4. internal brine plenum with slotted PVC filter pipe
5. Water inlet conically gusseted flanged nozzle with 1-¼ inch PVC ring
6. The brine tank will include a water inlet distributor to prevent uneven distribution of water. This shall consist of a schedule 80 PVC ring induction header around the inside circumference of the tank.
7. One 8 inch FRP gooseneck vent with PVC vent extension, clips to attach to tank wall, polyester dust bag and rubber connection boot.
8. Drain conically gusseted flanged nozzle
9. Pressure transmitter level assembly connection with an internal half round short stilling well (open top and bottom)
10. Top flanged manway with neoprene gasket and cover spring loaded for emergency pressure relief of 1 psi
11. Side flanged manway with cover, neoprene gasket, and stainless-steel fasteners
12. Salt level sensor connection
13. One fiberglass encapsulated nameplate
14. Fiberglass ladder with safety cage in accordance with OSHA and local standards, FRP support clips, stainless steel fasteners and anchor bolts as required. Support ladder directly on the concrete foundation and attach to the tank wall with fiberglass ladder clips. The ladder shall extend from the top of the tank to the concrete floor, which includes the height of the support pad. The ladder shall be located adjacent to the tank manway at the top of the tank.
15. Non-slip surface on the entire dome top and handrails around the tank for safety of the operators.
16. The Liquid and Salt Level System shall include the following:

    a. Local Controller/Control Panel which includes:

1) Analog 4-20 mA level indication output for SCADA system
2) Analog 4-20mA input for salt level reading
3) 24VDC output for salt reading command
4) 120VAC relay for water feed solenoid valve control
5) Analog 4-20mA input for liquid level reading

b. Pressure transducer/Transmitter

c. 1-inch normally closed solenoid valve (120VAC, 1 ph, 60 Hz). The solenoid valve shall be mounted by the Installation Contractor in the water inlet line to the Brine tank and shall be activated by the Local Control Panel.

d. Yo-Yo type solids level sensor.

B. The brine generator shall be suitable for outdoor installation and have heating elements and insulation necessary to maintain functional brining operation and prevent expansion to internal components. The brine generator will be manufactured to current ASTM standards, using USDA-approved resins, and must meet food grade sanitary guidelines.

C. Current demands will be determined by a temperature probe installed against the tank wall under the foam insulation. System shall be able to maintain 60°F at a minimum temperature of 0°F. The first six feet of the brine vessel is to be insulated with 2-inch thick Polyisocyanurate foam or approved equal with FRP protective covering. The top of the insulation will be capped to seal out any moisture.

D. A dust bag assembly shall be installed at the end of the brine tank vent line to reduce the release of salt dust inside a building or atmosphere while the brine tank is being pneumatically filled with salt. The bag shall be made of a polyester fabric.

E. A brine guard shall be provided to filter salt particle from clogging. It shall be a single collection plenum configuration (6 GPM brine flow rate design for 10’0” Diameter Brine Tank). It shall be designed for use with all screen salt sizes including table salt grades. The collector configuration for installation through 24" side wall manway. A 2" Flanged/ or MNPT discharge connection to match existing tank configuration. All materials NSF-61 accepted SCH80 PVC/HDPE.

F. Material and construction

1. Tank shall be manufactured in accordance with ASTM D-3299-95a.

2. The laminate shall consist of an interior surface, and interior layer, a structural layer and an exterior protective surface.

3. The interior surface shall be free from cracks and crazes.

4. The interior layer shall back the interior surface and have a minimum content of twenty to thirty percent non-continuous glass strands.

5. The finished laminate shall be free from visual defects such as dry spots, foreign inclusions, pinholes, and delamination.

6. The structural layer shall consist of continuous strand filament winding to satisfy hoop strength requirements; chopped glass is to be applied prior to the first cycle of winding and interspersed between subsequent cycles. The tank bottom and a minimum of the first 6 feet of the tank wall shall be fabricated without any structural seams.

7. The vessel shall have a minimum of two percent ultraviolet inhibitors.

2.11 BRINE FILTER

A. The EQUIPMENT SUPPLIER shall provide two (2) feed brine filter with wall bracket adapter. If multiple filters are provided, installation shall be in a parallel arrangement to allow for all filters to operate at the same time.

B. Filter housing shall be
   1. Pentek Products Filter Housing or equal
   2. Big Blue, 20" Long
   3. Integrated pressure relief valve
   4. 1-½" FPT inlet/outlet connection

C. Filter cartridge shall be
   1. 5-micron
   2. Pleated disposable cartridge

D. Two (2) pressure gauges shall measure pressure drop across filter assembly.
   1. Pressure gauge shall be
      a. WIKA copper allow Bourdon tube or equal
      b. Polycarbonate window
      c. Glycerin Filled
      d. ¼" NPT connection
      e. 0-100 PSI range

E. Two (2) gauge guards shall to protect the pressure gauges from the brine solution.
   1. Gauge guard shall be
      a. PVC SCH80 material
      b. Teflon diaphragm seal
      c. ½" x ¼" FPT connection

F. Each filter shall have Two (2) isolation valves
   1. Spears true union standard ball valves or equal
   2. ¾" NPT
   3. Viton seal

2.12 BRINE BOOSTER PUMP

A. The EQUIPMENT SUPPLIER shall furnish a brine booster pump to pump the saturated brine solution from the brine tank to the generator.

B. The brine booster pump shall be a MARCH BC-3CP-MD - Single Pump with a capacity of 10 gpm maximum flow at 20 ft TDH (9 psi)

2.13 OXIDANT STORAGE TANK LEVEL CONTROLS

A. Provide a bulk tank level control panel that will monitor the existing bulk tank 4-20 mA level signals and signal the generators when to start and stop. Three signal isolators are required to capture the level signals from the existing loops. A selector switch is also required to select the controlling tank.

2.14 HYDROGEN DETECTOR

A. The EQUIPMENT SUPPLIER shall provide Hydrogen Gas Detectors (loose shipped) to be field installed and wired by the Installation Contractor.

B. The gas sensor shall be mounted at the highest logical point in the room above the generator skid and above the oxidant storage tank.

C. Each Hydrogen Gas Detector shall consist of:

1. One (1) Gas transmitter with 0-100% LEL range (H2 specific) including the following features:
    a. The Controller shall be type wall-mounting single-channel controller for combustible gas, toxic gas or oxygen detection.
    b. The controller shall be configurable using internal controls, no hardware changes or jumper selection required.
    c. Backlit LCD display with adjustable contrast control for variation in ambient lighting.
    d. Audible and visual alarm indicator with alarm silence and reset button
    e. Wall mounting gray polycarbonate NEMA-4X enclosure with hinged cover.
    f. Operating voltage range: 115VAC or 230VAC
    g. Outputs:
        1) One (1) analog 4-20mA corresponding to 0-100% full scale
        2) Two (2) 24VDC alarm relay
2. Two (2) Catalytic bead type sensors with junction boxes.
    a. Enclosure
        1) Surface-mounting cast aluminum enclosure with screw-on cover.
        2) Wiring access through ¾" NPT female opening on enclosure.
        3) Sensor mounted to opposite opening.
    b. Hydrogen Sensors
        1) Catalytic bead type combustible sensor.
        2) Range: 0-100% LEL.
        3) Encapsulated in stainless steel enclosure.
        4) Sensor shall be special formulation that will only respond to hydrogen gas. Sensor will not respond to any other flammable gases and vapors.
        5) Sensor to be supplied with screw-on adaptor that allow remote application of calibration gas for testing and also protects sensor from dust/splash.
3. The Hydrogen Gas Detector shall be provided with a calibration kit including calibration adapter, 50% LEL hydrogen cylinder (balance in air), regulator, and carrying case.

2.15 MIXED OXIDANT DOSING SYSTEM

A. General requirement

1. The metering pump(s) operating configuration and conditions shall be as follows:

a.	Number of injection points:	Two (2)
b.	Number of pump(s) required:	Three (2 on the skid + 1 on the shelf spare)
c.	Pump(s) operation configuration:	1(Qty) Duty 1(Qty) Standby + One on the shelf spare
d.	Flow rate capacity (max) per pump:	290 gph
e.	Flow rate capacity (min) per pump:	20 gph
f.	Rated Discharge pressure (max) per pump:	58 psig
g.	Operating discharge pressure:	30 psig
h.	Turndown Ratio (min)	20:1
i.	Power requirements	110 VAC/ 1 PH/ 60 Hz

2. All metering pump(s) shall be NSF/ANSI 61
3. All metering pump(s) shall be designed for 24 hours per day operation.
4. The metering pump materials shall be completely suitable for and inert to liquid sodium hypochlorite up to 12 percent solution and at ambient, outdoor temperatures.
5. All wetted surfaces of feed pumps and appurtenances and all sealing gaskets shall be suitable for continuous exposure to sodium hypochlorite (12 percent solution, specific gravity = 1.23 maximum concentration). Pumps shall operate under suction lift and flooded suction conditions.
6. Each pump shall have the capabilities of manual speed control, automatic speed control from an external signal or automatic stroke length control. Signals shall be at a minimum:
   a. Run/Stop command
   b. Analog Speed Adjustment
   c. General Alarm
   d. Fault
   e. Run status
   f. Speed feedback

B. Diaphragm Pump(s)

1. Pumps shall be ProMinent Fluid Controls, Inc. “Sigma” series or approved equal.
2. The injection metering pump(s) shall be reciprocating, positive displacement and motor driven.
3. The pump shall be driven by a TEFC Duty electric motor.
4. Stroke volume shall be freely adjustable between 0 and 100% via a micrometer (manual knob).
5. The suction and discharge check shall be able to be removed and disassembled for inspection, cleaning or replacement.
6. The metering pumps shall be controlled by the following:

a. **Compound Loop:** Each pump shall be supplied with an integrated control system or a standalone variable frequency drive in a NEMA 4 enclosure mounted next to the metering pump stand or skid. The Plant's SCADA System shall provide a Start/Stop and speed signal to the pump's integrated controls or standalone VFD based on a flow and chlorine residual analog input signal to adjust the pump speed automatically. For added turn-down ratio, the stroke length shall be manually adjusted on diaphragm pump(s) only.

C. Pre-assembled skid or wall panel

1. Each skid/panel assembly is complete, including chemical pump(s), all necessary piping, valves, fittings, supports, electrical controls and accessories as specified herein. The skid/panel piping design shall minimize the use of glued joints in the system.
2. Skid/panel hydraulic connections
   a. Each skid/panel shall have one (1) inlet manifold connection.
   b. For single pump skid/panel, assembly shall have one (1) outlet connection
3. For Dual pump skid/panel with a single injection point, skid/panel shall have a single outlet connection.
4. For multiple pump skid/panel, assembly shall have One (1) outlet connection per pump.
5. The skid/panel shall contain the following items:
   a. Single Pump Floor skid:
      1) One (1) Non-metallic skid with built in containment area
      2) One (1) backpressure valve.
      3) One (1) main inlet strainer
      4) One (1) pressure gauge with gauge isolator
      5) One (1) pressure relief valve.
      6) One (1) pulsation dampener.
      7) One (1) calibration column
      8) One (1) NEMA 4X junction box
      9) One (1) set of isolation valves, true union PVC SCH80 with VITON seals
6. For duty/standby dual pump skid/panel, all accessories will be common/share to both pumps. No need to duplicate any accessories.
7. Interconnect piping, fittings and support(s) outside of pre-assembled skid/panel shall be supplied by installing contractor or by others.

2.16 TOOLS, SPARE PARTS, AND MAINTENANCE MANUALS

A. The OSGMOS SYSTEM Supplier shall furnish one set of the following spare parts for each OSGMOS installation as an Option.

1. One (1) each electrolytic cell Water inlet temperature transmitter assembly
2. One (1) each electrolytic cell Oxidant outlet temperature transmitter assembly
3. One (1) set of pump spare kit for each type of pump.
4. Spare fuses for the Control Panel (included in the Control Panel)

B. Spare parts shall be packed and consolidated in a single box with clear indelible identification markings and shall be stored in a dry and warm location until transferred to the Owner at the completion of the contract along with a packing list for future re-order.

C. The OSGMOS System Supplier shall furnish One (1) maintenance kit which includes chlorine test kit, water hardness test kit, hydrometer, dial thermometer, graduated cylinder, salinity chart, cartridge filter, tools and the Operation & Maintenance Log Book.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. The Owner shall inspect all equipment and materials against the OSGMOS System Supplier's approved Shop Drawings at time of delivery. Equipment and materials damaged or not meeting requirements of the OSGMOS System Supplier's approved shop drawings shall be immediately returned to the OSGMOS System Supplier for replacement or repair. Equipment and materials damaged during shipment shall be replaced or repaired based on the terms of the insurance.

B. Equipment and materials shall be stored in a cool dry location and protected from the elements according to the OSGMOS Supplier's instructions.

C. Equipment and materials shall be handled in an approved manner according to the OSGMOS Supplier's instructions.

3.2 INSTALLATION

A. Installation of the OSGMOS, metering pumps, tanks and appurtenances shall be performed by the Installation Contractor and shall be in accordance with the OSGMOS Supplier's approved drawings. Any deviations from the approved drawings shall be repaired at the contractor's expense. Conflicts of information shall be called to the attention of the Engineer.

B. As applicable, all equipment or assemblies shall be installed on concrete bases and secured with anchor bolts provided by the Installation Contractor. The Installation Contractor shall determine the anchor bolts size, length, material and make. Only the equipment bolt pattern shall be in accordance with the OSGMOS Supplier's approved drawings. The concrete bases shall be poured up to 1-inch below the metal bases, legs or soleplates. Equipment legs or base plates shall be accurately shimmed to grade and the spaces between filled with an approved non-shrink grout. After the grout has reached its initial set, exposed edges shall be cut back 2 inches and the edges neatly finished with 1:2 cement mortar.

C. The Installation Contractor shall provide a drain for each piece of equipment as required.

D. The Installation Contractor shall support piping independent of equipment. Equipment shall be free from all loads and stresses induced by the piping. No vibration or movements are allowed.

E. All equipment including motors, belts and drives shall be aligned to the best industrial standards by the Installation Contractor. The Installation Contractor shall conduct field check and adjust all equipment alignments in the presence of the Owner or the Owner's designated representative.

F. The Installation Contractor shall inspect all equipment before installation. If damaged, the Installation Contractor shall notify the OSGMOS System Supplier promptly. The Installation Contractor shall not install damaged equipment.

G. The Installation Contractor shall have an authorized inspector as designated by the tank manufacturer to validate the proper installation of all tanks.

H. The Installation Contractor shall install flex couplings or flexible hoses at the bottom inlet, the bottom outlet of any plastic tank, and any other location as noted by sticker(s) on the tank by the tank manufacturer. The flex connections shall be in accordance with the tank manufacturer's specifications.

I. The Installation Contractor shall install CPVC SCH80 pipe material, fittings and accessories in between each OSGMOS unit(s) and the intended storage tank(s). PVDF shall be allowed on specific fittings and/or accessories.

J. The Installation Contractor shall install disconnect switches for each transformer/rectifier, blower, water heater, water chiller, water booster pump, hypochlorite metering pump and/or any other electrical equipment requiring it per code.

3.3 COMMISSIONNING AND START-UP SERVICES

A. The Installation Contractor shall complete the OSGMOS Supplier's pre-startup checklist after the installation of the OSGMOS System is complete and provide digital pictures of the installation from the beginning to end of the process as reflected in the P&ID and defined in the scope to schedule the OEM representative.

B. The Installation Contractor shall verify that all Health & Safety related installations such as electrical grounding/bonding, Safety guards and warning signs in place, Eyewash stations are installed.

C. The Installation Contractor shall verify whether OSGMOS was stored properly for short or extended period per OSGMOS supplier's guidelines.

D. The Installation Contractor shall verify and confirm the following items for the efficient operation of the OSGMOS System:

1. Water, brine and salt quality per OSGMOS Supplier's specifications;
2. Plumbing connections to and from all equipment, components, and instruments are completed;
3. Plumbing material for all equipment, components, and instruments are as per manufacturer's recommendations/requirements.
4. Plumbing connections to drains are available;
5. Plant SCADA wired from skid(s) PLC to control room;
6. Plant SCADA is ready and active

E. The Installation Contractor shall coordinate commissioning of the system and verify that each component of the OSGMOS System is ready for operation.

F. The Installation Contractor shall, after the installation of the storage tank(s) is complete but before the piping connections are made, block all outlets and fill each tank with water (not air) to check for leaks. No leakage shall be permitted.

G. The Installation Contractor shall test and verify SCADA communications in the presence of the OSGMOS Supplier at the time of system start-up. The presence of the site SCADA integrator is required at the time of start-up to ensure that all data are being sent and received.

H. The OSGMOS supplier's Field Services personnel or factory trained representative shall perform the services listed below for each Hypochlorite generator and applicable dosing system(s).

1. Test, calibrate and adjust all OSGMOS provided components for best performance.

2. Assist in initial start-up and field-testing.
3. Instruct Owner's personnel in the operation, maintenance and troubleshooting of all components. Conduct a training seminar at the site.
4. Supervise the correction of any defective or faulty work before and during start-up of the system.

3.4 PERFORMANCE TEST

A. The Installation Contractor and OSGMOS Supplier shall make equipment adjustments such as adjusting plant water pressure required to place system in proper operating condition.

B. Necessary pre-requisites for the performance test are:
   1. System must be running and stabilized before the test period starts.
   2. Incoming water pressure at each OSG skid is 25 psi minimum, and lower than 100 psi.
   3. Incoming water temperature is higher than 55°F, and lower than 80°F.
   4. Incoming water hardness after water softeners is less than 17 mg/L.

C. In order to determine compliance of the OSGMOS System with the performance requirements set forth in this specification, the following test will be performed at commissioning.
   1. Mixed Oxidant Solution Concentration
      a. Mixed Oxidant solution samples shall be taken at the outlet of the On-Site Generator.
      b. One sample shall be taken.
      c. Samples shall be analyzed for available chlorine concentration in accordance with Standard Methods Method 4500-Cl G. DPD Colorimetric Method as adapted by Bradford (2010) for concentrated neat solutions to use the Hach Company Method 8201 Chlorine, Free by the DPD Method.
      d. The test shall be deemed successful if the average chlorine concentration is between 0.35% and 0.55% (3,500 to 5,500 mg/L).
   2. Generation Capacity
      a. The generating capacity of the unit shall be calculated by multiplying the system flow rate (GPH) with the free available chlorine concentration times .0002 using a 15 second graduated cylinder flow measurement.
      b. The generator capacity shall be reported in equivalent pounds per day.
      c. The test shall be deemed successful if the generator capacity is greater than 120lbs/day.

D. Once both performance tests are successful, the Installation Contractor shall issue a Final Acceptance letter to the OSGMOS supplier.

E. If the Mixed Oxidant feed system fails to meet any of the specified performance requirements, the Installation Contractor and/or OSGMOS Supplier shall modify and/or replace defective equipment until it meets specified requirements. Re-test system to verify satisfactory operation.

3.5 TRAINING

A. Site Technical Training

1. The EQUIPMENT SUPPLIER shall provide operator training at the site for a period no less than four (4), eight (8) hour day(s). Training shall include operation, maintenance and troubleshooting for each component of the OSGMOS.

SECTION 13240

OVERHEAD BRIDGE CRANE (2-TON CAPACITY)

PART 1 – GENERAL

1.01 SCOPE

Furnish, deliver, install, test, and commission one complete overhead bridge crane system including bridge, hoist, trolley, runway interface, controls, and all required accessories.

1.02 DESIGN CRITERIA

- Rated Capacity: 2 tons (4,000 lbs)
- Crane Type: Top-running single girder bridge crane *(or underhung if required)*
- Service Classification: CMAA Class C (Moderate Service)
- Span: see drawings
- Lift Height: see drawings

1.03 APPLICABLE STANDARDS

Comply with the latest editions of:

- Crane Manufacturers Association of America (CMAA 70 or 74)
- American Society of Mechanical Engineers (ASME B30.2, B30.16)
- Occupational Safety and Health Administration (OSHA 1910.179)
- National Electrical Manufacturers Association
- National Fire Protection Association (NFPA 70 – NEC)

1.04 SUBMITTALS

Provide:

- Shop drawings (layout, loads, clearances)
- Structural reactions (wheel loads, end truck loads)
- Electrical schematics
- Manufacturer data sheets
- O&M manuals
- Load test certification

PART 2 – PRODUCTS

2.01 BRIDGE STRUCTURE

- Single girder welded steel construction
- Designed for minimum deflection of L/600
- End trucks with precision-machined wheels

- Bridge travel via motorized end trucks

2.02 HOIST

- Type: Electric wire rope hoist *(preferred)* or electric chain hoist
- Capacity: 2 tons minimum
- Lift Speed: Two-speed or VFD-controlled
- Hoist Motor: Totally enclosed, fan-cooled (TEFC)
- Duty Rating: Minimum H4 (ASME)

2.03 TROLLEY

- Motorized trolley, synchronized with hoist
- Steel wheels with anti-drop provisions
- Adjustable to beam flange width

2.04 DRIVE SYSTEM

- Bridge and trolley drives:
  - VFD-controlled preferred
  - Smooth acceleration/deceleration
- Motors: TEFC, inverter duty rated

2.05 CONTROLS

- Pendant control station with:
  - Up/down, trolley, and bridge motion
  - Emergency stop
- Optional: Radio remote control system
- Control voltage: 120V max

2.06 ELECTRICAL SYSTEM

- Power Supply: **208V / 3-phase / 60 Hz**
- Festoon system for bridge electrification
- NEMA-4X enclosures suitable for environment

2.07 RUNWAY INTERFACE

- Compatible with runway beams (coordinate with PEMB manufacturer)
- Provide:
  - End stops
  - Bumpers
  - Rail sweeps

2.08 SAFETY FEATURES

- Upper and lower limit switches
- Overload protection

- Emergency stop
- Hook with safety latch
- Brake system: Fail-safe, electrically released

2.09 FINISH

- Shop primer + industrial enamel topcoat
- Color: Manufacturer standard or specified

PART 3 – EXECUTION

3.01 INSTALLATION

- Install per manufacturer recommendations
- Align crane to minimize skewing
- Verify runway tolerances

3.02 TESTING

- Perform operational testing
- Perform load test at 125% rated capacity
- Provide certified test report

3.03 TRAINING

- Provide operator training session
- Provide maintenance training

3.04 WARRANTY

- Minimum **1-year warranty** on parts and labor

SECTION 13300 – SPECIAL STRUCTURES
PRE-ENGINEERED STRUCTURES – PANELS & INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-engineered building and components including the following:
   1. Roof covering system including exterior roof panels, panel attachments, sealants, mastics, trim and flashings.
   2. Exterior panels including wall, liner and soffit panels.
   3. Insulation.

B. Wall accessories including the following:
   1. Service doors.
   2. Wall openings.

C. Roof accessories including the following:
   1. Eave gutters.
   2. Multi-gutters and valley gutters.
   3. Translucent roof panels.
   4. Roof curbs.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 09 90 00 - Painting.

C. Section 13 34 19 – Pre-Engineered Structures – Structural Framing
   1. Structural steel frame, secondary framing, and miscellaneous framing.

1.3 REFERENCES

A. American Institute of Steel Construction (AISC):
   1. AISC 360 - Specification for Structural Steel Buildings.
   2. AISC 341 - Seismic Provisions for Structural Steel Buildings (when appropriate).
   3. AISC Design Guide 3 - Serviceability for Steel Buildings

B. American Iron and Steel Institute (AISI):
   1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

C. American Welding Society (AWS):
   1. AWS D1.1 / D1.1M - Structural Welding Code - Steel.
   2. AWS D1.3 / D1.3M - Structural Welding Code - Sheet Steel.

D. Association for Iron & Steel Technology (AISE):
   1. AISE 13 - Specifications for Design and Construction of Mill Buildings.

E. ASTM International (ASTM):
   1. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   2. ASTM A 653 / A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A 792 / A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

4. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
5. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
7. ASTM D 522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
8. ASTM D 523 - Standard Test Method for Specular Gloss.
9. ASTM D 968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
10. ASTM D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
11. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
12. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
13. ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
14. ASTM D 3361 - Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
15. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
16. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E 96 / E 96M - Standard Test Methods for Water Vapor Transmission of Materials.
18. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
19. ASTM G 87 - Standard Practice for Conducting Moist SO2 Tests.

F. FM Global:
1. FMRC Standard 4471 - Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance.

G. Metal Building Manufacturers Association (MBMA):
1. MBMA Metal Building Systems Manual.
2. Seismic Design Guide for Metal Building Systems.

H. North American Insulation Manufacturers Association (NAIMA):
1. NAIMA 202 - Standard For Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.

I. The Society for Protective Coatings (SSPC):
1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.
2. SSPC-SP2 - Hand Tool Cleaning.

J. Underwriters Laboratories (UL):
1. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.
2. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 DEFINITIONS

A. Building Width: Measured from outside to outside of sidewall girts. Typically edge to edge of concrete.

B. Building Length: Measured from outside to outside of end wall girts. Typically edge to edge of concrete

C. Building Line: Outside face of steel/girt.

D. Building Eave Height: Measured from the top of the eave member at the outside of the sidewall girt line to the bottom of the sidewall column base plate or to finished floor if columns are on grout or recessed below finished floor.

E. Bay Spacing: Measured from centerline to centerline of primary frames for interior bays and from centerline of the first interior frame to outside of end wall girts for end bays.

F. Roof Pitch: The ratio of the vertical rise to the horizontal run (i.e. 1:12 = 1 inch of rise for every foot of horizontal dimension).

1.5 SYSTEM DESCRIPTION

A. General:
   1. Provide metal building frame, metal wall panels, metal roof panels, accessories and miscellaneous materials for a complete enclosure including supports for building components specified in other sections.
   2. Design structural systems according to professionally recognized methods and standards and legally adopted building codes.
   3. Design under supervision of professional engineer licensed in the jurisdiction of the Project.

B. Design Requirements:
   1. Bay size: per Drawings.
   2. Roof pitch: per Drawings.
   3. Building location zip code: 40324.
   4. All load and code information must be obtained directly from the authority having jurisdiction.

C. Performance Requirements:
   1. System to withstand gravity and lateral loads in compliance with contract documents.
   2. Refer to contract drawings for additional concentrated loads to pre-engineered building hanger beams and support jacks.
   3. Metal wall panels (interior and exterior) shall not to be used as shear elements. Specify if metal wall and girt assembly require specific deflection constraints
   4. Construct assembly to permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 100 degrees F (37 degrees C) in a 24 hour period.

   5. Design and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance. Some oil canning in rolled panels especially in the flats of the panel is normal and is not cause for rejection

1.6 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Design Data: Provide detailed design criteria and calculations prepared by a licensed structural engineer.

C. Certification: Manufacturer certification that the building conforms to the contract documents and manufacturer's standard design procedures.

D. Shop Drawings: Show building layout, primary and secondary framing member sizes and locations, cross-sections, and product and connection details.
   1. Anchor Bolt Installation Drawings: Layouts with minimum bolt diameters (anchors are typically by others in the metal building industry).

E. Product Data: Information on manufactured products to be incorporated into the project.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

H. Certificates: Welder certifications

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Not less than 5 years of experience in the actual production of specified products.
   1. Member of the Metal Building Manufacturer's Association (MBMA).
   2. Primary manufacturer of frames, secondary steel, roof and wall sheeting, and trim.

B. Installer Qualifications - Firm experienced in application or installation of systems similar in complexity to those required for this project, plus the following:
   1. Acceptable to or licensed by manufacturer.
   2. 3 years of experience with systems.
   3. Successfully completed not less than 5 comparable scale projects using this system.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 WARRANTY

A. Manufacturer shall warranty installed system for the periods described herein, starting from Date of Substantial Completion or ninety days from delivery, whichever comes first, against all the conditions indicated below. When notified in writing from Owner, manufacturer/installer shall, promptly and without inconvenience and cost to Owner, correct said deficiencies.
   1. Materials and Workmanship Warranty:
      a. Warranty Period: 3 years, standard.
   2. No Dollar Limit (NDL) Material and Workmanship Warranty:
      a. Warranty Period: 3 years, standard.
   3. Panel Rib Standard Weathertight Warranty:
      a. Warranty Period: 10 years, standard.
   4. SSR/SLR Standard Weathertight Endorsement:
      a. Warranty Period: 10 years.
   5. SSR/SLR Optima Weathertight Endorsement:
      a. Warranty Period: 10 years.
   6. No Dollar Limit (NDL) Weathertight Endorsement:
      a. Warranty Period: 10 years.
   7. Structural NDL Endorsement:
      a. Warranty Period: 10 years.
   8. Finish Warranty:
      a. Finish coating shall not peel, blister, chip, crack or check in finish, and shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D 4214.
      b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D 2244.
         1) Panel finish: 25 years.
   9. Performance Warranty: Furnish written warranty, stating sheet metal roofing system and flashing (flashing under premium warranty only) under this Section will be maintained in watertight condition and defects resulting from the following items will be corrected without cost to Owner for a period of 10 or 20 years.
      a. Faulty workmanship.
      b. Defective materials including sealants and fasteners.
      c. Water infiltration.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Varco Pruden Buildings, which is located at: 3200 Players Club Circle; Memphis, TN 38125; Toll Free Tel: 866-538-0012; Tel: 901-748-8000; Fax: 901-748-9323; Email: request info (vpsales@vp.com); Web: www.vp.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 ROOF COVERING SYSTEM

A. Roof Panels: "SSR" Standing Seam Roof Panels; 24 inches wide net coverage, with 3 inches high major ribs formed at the panel side laps, formed for field seaming using electrically operated seaming machine.

1. Side joints: Factory applied sealant.
2. Material (Painted): AZ50 Galvalume coated steel.
3. Material (Unpainted): Acrylic coated AZ55 Galvalume steel unpainted.
4. Thickness: 24 gage (0.58 mm).
5. Standard Roof pitches ranges from 1/4 inch:12 up to 4 inches:12
6. Side laps: Two factory-formed interlocking ribs, with one weather sealed joint, field-seamed into place to form a double-fold 360 degree seam.
7. Length: Continuous from eave to ridge up to 55 feet in length.
8. End laps, where required: 4 inches wide, located at a support member.
9. Panel-to-roof purlin structural attachments: SSR clips with movable tabs which interlock with seamed SSR panel ribs and provide for 1-5/8 inches (41 mm) of panel movement in either direction from center of clip to compensate for thermal effects.
10. SSR Ridge; draw-formed aluminum seam caps factory-attached to SSR ridge panels that are seamed together along the center of the ridge, utilizing only one weather sealed joint and providing a true expansion joint for panel movement.
11. Rake edge of roof shall be attached to the building structure in a manner which will allow thermal expansion of the SSR roof panels along the gables and will provide the uplift resistance required by code.
12. SSR roof will meet the requirements for UL Class 90 wind uplift and FM Class 1-60, 1-75, 1-90 and 1-120. Certification includes IAS.
13. The KXL paint system is a PVDF finish applied to the zinc aluminum coated steel to give a long life color that resists fading and chalking. KXL is a 1 mil nom. PVDF finish with 70 percent Kynar 500 or Hylar 5000 standard.
14. Exposed fasteners are stainless steel capped painted to match roof color.
15. SSR roof will meet the requirements for UL Class 60 or 90 wind uplift. Certification includes IAS and Miami-Dade County Florida product approval. FM Class 1 Roof Assembly, Class A Fire classification (ASTM E 108).

2.3 EXTERIOR PANELS

A. Wall Panels: Tech Four, 16 inch wide net coverage with alternating 4 inch by 7/16 inch box corrugations with hidden joints, concealing fasteners between panels
   1. Material: 24 ga G-90 Galvanized steel ASTM A 653.
   2. Surface: Embossed finish.
   3. Length: Continuous from sill to eave up to 46 feet (14 m) in length.
   4. Splices: Located at a support member, where required.
   5. Side joints: Continuous interlocking side joints with concealed fasteners.
   6. Tech Four is available with a 25 year finish warranty.
   7. The KXL paint system is a PVDF finish applied to the Galvanized coated steel to give a long life color that resists fading and chalking. KXL is a 1 mil nom. PVDF finish with 70 percent Kynar 500 or Hylar 5000.

B. Liner Panels: LPR-36; 36 inch wide net coverage, with 1-3/16 inch high major ribs with minor ribs spaced between the major ribs.
   1. Material: AZ50 Galvalume coated steel.
   2. Thickness: 28 gage, Cool Cotton White, SMP Silicone-Modified Polyester finish.
   3. Length: Continuous from sill to eave up to 43 feet in length.
   4. Side laps: Two fully overlapping major ribs secured together with 1/4 inch diameter Stainless Steel capped color-matched carbon steel fasteners.
   5. Provide partial height wall liner panels, refer to drawings.
   6. Provide eave height liner panels.
   7. Provide full height liner panels.

C. Soffit Panels: FP-12 Architectural Soffit Panels; 12 inch wide net coverage, 7/8 inch deep profile. Include one or two stiffening beads on panels over 15 feet.
   1. Material: Prefinished AZ50 Galvalume coated steel.
   2. Thickness: 26 gage.
   3. Thickness: 24 gage.
   4. Side joints: Continuous interlocking side joints with concealed fasteners.
   5. Panel length: 12 inch minimum to 30 feet maximum.
   6. The KXL paint system is a PVDF finish applied to the zinc aluminum coated steel to give a long life color that resists fading and chalking. KXL is a 1 mil nom. PVDF finish with 70 percent Kynar 500 or Hylar 5000 standard.

2.4 INSULATION

A. Laminated Fiberglass: Owens-Corning Fiberglas, NAIMA 202, "Certified R" metal building insulation.
   1. TIMA Insignia and Insulation Thickness: Ink-jet printed on fiberglass.

B. Back-Fill Insulation: Owens-Corning Fiberglas unfaced "Metal Building Insulation Plus".
C. Roof Insulation:
   1. Nominal Thickness: 6 inches.
   2. Certified R-Value: R-19.
D. Wall Insulation:
   1. Nominal Thickness: 6 inches.
   2. Certified R-Value: R-19.
E. Roof and Wall Insulation Facing: PSK Heavy Duty (WMP-30).
   1. 0.0005-inch-thick, UV-stabilized, white metalized polypropylene laminated to 30-pound Kraft paper, reinforced with glass-fiber scrim.
   2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.02.

2.5 WALL ACCESSORIES

A. Service Doors - 700 Series Pre-Assembled:
   1. Size: 3070.
   2. Description: Beige only primed, UL fire rated, wind rated, jamb extensions, multiple keying options, half glass, vertical glass, kick plates and crash chains.
   3. Doors: 18 gauge galvanized (A60), polyurethane, R11, insulated core, interlocking seam. Doors meet commercial Steel Door Institute (SDI) standards.
   4. Frames: Welded frame, 16 gauge galvanized (A60), 5-3/4 inch (146 mm) standard frame profile, interlocking corner connection (then welded). Frames meet (SDI) standards.
   5. Locks: Shlage Grade 2, AL53PD-626-SAT. Meet ANSI A156.2 series 4000, grade 1 requirement. Three-year warranty. Thru bolted for added strength. Free-wheeling vandal resistant lever.
   6. Subjambs: Proprietary offset subjamb/jamb anchor system - tested to 1,000,000 cycles. 16 gauge galv. (A40 min.) subjamb. Polyethylene block anchors stiffen jambs and allow for offset design. Self-trimming, no jamb trim required.
   7. Paint Finish: All doors and frame have a baked-on beige primer coat meeting ANSI A250.1 standards. Paint test for salt spray, humidity, and adhesion.

8. Hinges: Ball bearing silver powder coat hinges with security non-removable pins.

B. Wall Openings: Cold-formed sheet metal framing concealed with manufacturer's standard colored trim.

2.6 ROOF ACCESSORIES

A. Eave Gutters: Roll-formed 26 gage steel sheet, with gutter straps, fasteners and joint sealant; manufacturer's standard color.
1. Downspouts: 26 gage 4 inches by 5 inches in 10 foot lengths, with downspout elbows and downspout straps; same color as wall panels unless specified otherwise.

B. Multi-Gutters and Valley Gutters: 0.059 inch (17 gage) thick cold-formed steel sheet.
1. Finish: G90/Z275 galvanized coated.

C. Translucent Roof Panels: Tuf-Lite; UV stabilized thermosetting polyester resin reinforced with chopped and woven roving glass fiber; manufacturer's standard configuration.
1. Color: White exterior surface and minimum 55-60 percent light transmittance.
2. Self-ignition temperature: 650 degrees F (343 degrees C) or greater, when tested in accordance with ASTM D 1929.
3. Smoke density index: 450 or less, when tested in accordance with ASTM E 84, or 75 or less, when tested in accordance with ASTM D 2843.
4. Extent of burning: 1 inch or less, when tested in accordance with ASTM D 635.
5. Rate of burning: 2.5 inches per minute or less, when tested in accordance with ASTM D 635.
6. Seamed in rails for the Tuf-lite only come in one color (Cool Cotton White) and shall be field painted to match other colors if required.
a. Provide UL 90 construction when required by roof performance.
b. Provide insulation pans where indicated or scheduled.

D. Roof Curbs: Welded units fabricated for shingled installation with roof panels; minimum 18 gage Galvalume coated steel, with welds cleaned and treated with protective coating compatible with the Galvalume substrate.
1. Top of curbs horizontal with 1-1/2 inch perimeter flange.
2. Curb walls insulated with 1-1/2 inch, 3 pcf density rigid glass fiber insulation.
3. Water diversion: Integral 4 inch high by full length cricket on upslope side.
4. Exposed curb flanges pre-drilled for correct fastener locations.
5. Upslope and down slope curb flanges with integral welded inside and outside cell closures compatible with the roof panel profile.
6. Curb framing: Mounted on secondary structural members and installed from the top; compatible with the thermal expansion and contraction properties of the roof on which it is used.
7. Opening size: As indicated on drawings.
8. Curbs for SSR Roof Panels: One-piece type.

2.7 MATERIALS

A. Structural Steel Plate, Bar, Sheet, and Strip for Use in Bolted and Welded Constructions: ASTM A 572/A 572M, A 529/A 529M, A 1011 or A 36/A 36M Modified 50, with minimum yield strength of 55,000 psi (380 MPa).

B. Galvanized Structural Steel Material for Use in Roll Formed or Press Broken Secondary

Structural Members: ASTM A 563, with minimum yield strength of 60,000 psi (410 MPa).

C. Galvanized Steel Sheet for Roll Formed or Press Broken Roof and Wall Coverings, Trim and Flashing: ASTM A 653/A 653M, with minimum yield strength of 50,000 psi (345 MPa).

D. Galvalume Steel Sheet Used in Roll Formed or Press Broken Roof Covering: Aluminum-zinc alloy-coated steel sheet, ASTM A 792/A 792M, with minimum yield strength of 50,000 psi (345 MPa); nominal coating weight of 0.5 oz per sq ft both sides, equivalent to an approximate coating thickness of 0.0018 inch both sides.

E. Hot Rolled Steel Shapes: W, M and S shapes, angles, rods, channels and other shapes; ASTM A 500, ASTM A 572/A 572M or ASTM A 36/A 36M as applicable; with minimum yield strengths required for the design.

F. Structural Bolts and Nuts Used with Primary Framing: High strength, ASTM A 325 bolts and ASTM A563 Grade C nuts.

G. Bolts and Nuts Used with Secondary Framing Members: High Strength ASTM A 325 Bolts and ASTM A 563 Grade C nuts.

H. Panel Fasteners:
1. For Galvalume and KXL finished roof and wall panels: Stainless Steel-capped carbon steel fasteners with integral sealing washer.
2. Color of exposed fastener heads to match the roof or wall panel finish.
3. Concealed Fasteners: Self-drilling type, of size as required.
4. Provide fasteners in quantities and location as required by the manufacturer.

I. 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 weather tightness and a finished appearance.

J. Sealants, Mastics and Closures: Manufacturer's standard type.
1. Provide at roof panel end laps, side laps, rake, eave, transitions and accessories as required to provide a weather resistant roof system; use tape mastic or gun grade sealant at side laps and end laps.
2. Provide at wall panel rakes, eaves, transitions and accessories.
3. Closures: Formed to match panel profiles; closed cell elastic material, manufacturer's standard color.
4. Tape mastic: Pre-formed butyl rubber-based, non-hardening, non-corrosive to metal; white or light gray.
5. Gun grade sealant: Non-skinning synthetic Elastomeric based material; gray or bronze.

2.8 FABRICATI0N

A. Fabrication: Fabricate according to manufacturer's standard practice.
1. Fabricate structural members made of welded plate sections by jointing the flanges and webs by continuous automatic submerged arc welding process.
2. Welding operators and processes: Qualified in accordance with AWS D1.1.
3. Field connections: Prepare members for bolted field connection by making punched, drilled, or reamed holes in the shop.

B. Component Identification: Mark all fabricated parts, either individually or by lot or group, using an identification marking corresponding to the marking shown on the shop drawings, using a method that remains visible after shop painting.

2.9 FINISH

A. Schedule of Finishes:
   1. Roof finish and color: to be selected from manufacturer's standard options.
   2. Wall finish and color: to be selected from manufacturer's standard options.
   3. Liner panel finish and color: to be selected from manufacturer's standard options.
   4. Soffit panels finish and color: to be selected from manufacturer's standard options.

B. Shop Coat: Manufacturer's standard rust inhibitive primer paint; manufacturer's standard color.
   1. Finish all structural steel members using one coat of manufacturer's standard shop coat, after cleaning of oil, dirt, loose scale and foreign matter.

C. KXL Pre-Painted Finish: 0.9 mil minimum dry film thickness 70 percent Kynar 500, Hylar 5000 coating on exterior surface.
   1. Color: Interior Finish: Off White 0.5 mil minimum dry film thickness wash coat.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and or timely completion.
   1. Verify foundations are properly installed, to correct dimensions and within acceptable tolerances.
   2. Verify location of covered or built-in work.
   3. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Framing Erection: Erect framing in compliance with AIS Specification and the latest edition of the MBMA metal building systems manual.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as required by manufacturer.

3.3 ERECTION OF FRAME

A. Install in accordance with manufacturer's instructions.
   1. Do not erect frames without complete installation of tie beams and anchorages.
   2. Set column base plates with non-shrink grout to full plate bearing.
   3. Do not field cut or alter structural members without written approval.
   4. After erection, prime welds, abrasions, and surfaces not primed with primer used in shop painting.

3.4 INSTALLATION

A. Install in compliance with manufacturer's instructions and approved submittals.
   1. Exercise care when cutting prefinished material to ensure cuttings do not remain

on finish surface.

2. Fasten cladding system to structural supports, aligned level and plumb.
3. Locate end laps over supports. End lap panels according to manufacturer's recommendations. Place side laps over adjacent panel and mechanically seam or stitch fastener per erection guidelines.
4. Provide expansion joints where indicated.
5. Use concealed fasteners.
6. Install sealant and gaskets to prevent weather penetration.
7. Install system free of rattles, noise due to thermal movement, and wind whistles.
8. Install door frames, service doors, overhead doors, window and glass, and gutter system in compliance with manufacturer's instructions.
9. Seal wall and roof accessories watertight and weather tight with sealant in compliance with building manufacturer's standard procedures.
10. Rigidly support and secure gutters and downspouts. Joint lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

B. Tolerances:
1. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
2. Racking: 1/8 inch from true position. Provide shoring to maintain position prior to cladding installation.

3.5 FIELD QUALITY CONTROL

A. Testing by Contractor:
1. Roof installation inspection by roof manufacturer's representative; as required as part of warranty provision.

B. Testing by Owner:
1. High Strength Bolted Connections: Specification for Structural Joints Using ASTM A 325 or A 490 Bolts, with minimum testing of bolted connections per the arbitration inspection procedure.
2. Welded Connections: AWS. Visual inspection of 100 percent of welds. Ultrasonic inspection of 50 percent of full and partial penetration welds. A rejection rate greater than 5 percent will increase the inspection to 100 percent.
3. General Testing: For materials and installed tolerances.

END OF SECTION

SECTION 13341 – METAL BUILDING SYSTEMS – STRUCTURAL FRAMING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes design, shop-fabrication and erection of pre-engineered steel building structural frame, as shown on drawings including plans, notes and details showing size and location of members.

B. Design and provision of crane support girders and columns are to be included under this contract. Refer to related specification sections for additional requirements.

C. Work supplied but installed under other Sections:

1. Division 3 Section “Cast-in-Place Concrete” for anchor bolts.

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Structural Inspection.”
2. Division 3 Section “Cast-in-Place Concrete.”
3. Division 8 Section “Overhead Coiling Doors.”
4. Division 9 Section “Painting.”
5. Division 13 Section “Pre-Engineered Building Components.”

1.3 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 referenced standards.

B. IAS: International Accreditation Service.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install pre-engineered structural steel frame to withstand design loadings indicated within limits and under conditions required.

1. The design of the pre-engineered building frame shall be in accordance with the 2018 Kentucky Building Code, 4th Edition (2018 KBC) (2015 International Building Code).
2. Manufacturer shall use contract drawing information indicating maximum depth, size, and spacing limitations.
3. Concentrated loads, resulting from bearing walls or other conventional structural steel framed into pre-engineered building components (designed and provide by others), are shown with diagrammatic sketches of the member, showing the placement and magnitude of the concentrated load. Pre-engineered building designer shall incorporate such loads into the design of the pre-engineered building frame.

4. The magnitude of the structure's mass dead load (W) for seismic calculations shall be determined by the engineer responsible for the design of the pre-engineered building structure. The pre-engineered building structure is the sole lateral force resisting system and shall be designed as such. All components of the building including , but not limited to, the exterior brick veneer and metal stud wall system, mechanical units, ceiling components, interior partitions, floor structures (even when designed by others), etc. shall be considered when calculating W.
5. Pre-engineered building frame supplier shall design and provide connections for conventional structural steel members framed into the pre-engineered building columns.

B. Engineering Responsibility: Engage a fabricator who uses a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

C. Wind loads shall be in accordance with chapter 16 of the 2018 KBC, chapters 26 through 30 of the ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, and the following:

1. Ultimate Design Wind Speed: 120 mph
2. Nominal Design Wind Speed: 93 mph
3. Risk Category: III
4. Exposure category: C
5. Enclosure Classification: Enclosed
6. Internal Pressure Coefficient: $\pm$ 0.18

D. Seismic loads shall be in accordance with chapter 16 of the 2018 Kentucky Building Code, chapters 11 and 12 of ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures,* and the following:

1. Seismic Risk Category: III
2. Importance factor: 1.25
3. Site Class: A
4. Short period mapped spectral acceleration (S_S): 0.187
5. 1 second period mapped spectral acceleration (S_1): 0.103
6. Design for structural systems not complying with AISC-Seismic Provisions for Structural Steel Buildings (where allowed by the 2018 KBC) shall utilize Response Modification Coefficient, System Overstrength Factor, and Deflection Amplification Factor for "Structural Steel Systems not Specifically Detailed for Seismic Resistance" as shown in ACSE 7-10 Table 12.2-1.

E. Snow loads shall be in accordance with chapter 16 of the 2018 KBC, chapter 7 of ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, and the following:

1. Importance factor: 1.10
2. Exposure factor: 0.9
3. Thermal factor: 1.0
4. Ground snow load: 15 psf

F. Live loads shall be in accordance with the 2018 KBC.

1. Live loads on roofs shall not be reduced for tributary live load reduction.

G. Dead loads shall include the self-weight of the pre-engineered building components, any roof supported mechanical equipment, and a collateral dead load for dead load imposed by ceilings, lights, mechanical ductwork, etc. as follows:

1. Roof Collateral Dead Load: 5 psf.

H. Building drift shall be limited to a maximum of H/300, where H equals the building height, for load combinations which include wind.

1. Drift limitations for seismic loading shall be as defined in the Kentucky Building Code. Use of Building Code exemption to drift design for buildings with partitions designed to accommodate story drift is prohibited.

I. Deflection of structural members shall be limited to the following:

1. Wind spandrel beams: Horizontal deflection of L/600 due to wind load, where L is the member length.
2. Wind girts and wind columns: Horizontal deflection of L/180 due to wind load, where L is the member length.
3. Primary and Secondary roof framing members: L/120 due to total load and L/180 due to live load, where L is the member length or horizontal distance from eave to eave.
4. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

J. Thermal Movements: 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 joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss when subjected to a temperature range of 125 degrees F.

1.5 ACTION SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

1. Shop drawings which show the Architect’s or Engineer’s title block, logo and/or seal will be rejected and returned unchecked.
2. Computer generated electronic structural construction document files (ACAD) will be made available to the Contractor. The Contractor will be required to sign the Engineer’s standard release of liability form prior to receiving the drawing files.
3. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.
4. Architect’s and Engineer’s review of the calculations is for general conformance with the contract documents. Actual calculations are the responsibility of the Metal Building System design engineer and shall not be reviewed for content or accuracy by the Architect or Engineer.

B. Building Permit Issuance: Contractor shall submit Anchor Bolt Plans and Reactions, calculations, and Shop Drawings to the Building Official. Submittal must be signed and sealed by a professional engineer registered in the state where the project is situated. Submittal typically must be received prior to processing of the building permit by the plans reviewer.

C. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins.

1. Provide setting drawings, templates, and directions for installation of anchor rods and other anchorages.

2. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation
3. Indicate design criteria and loading (wind, snow, seismic, live) as specified in section 1603 of the Kentucky Building Code on the shop drawing cover sheet.
4. Provide foundation reactions for each load type.

D. Shop Drawings detailing fabrication and erection of pre-engineered building structural components. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes

1. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, openings, fasteners, and ASTM specifications for materials.
2. Indicate field welds by standard AWS symbols, showing size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Include erection plans and details.
4. Include ASTM material specifications and grade of steel.
5. Provide erection details of all field connections.
6. Indicate surface preparation for primer, primer, and galvanizing to be used.
7. To the extent pre-engineered building design considerations are indicated as fabricator's responsibility, provide shop drawings signed and sealed by the qualified professional engineer, registered in the State of Kentucky, responsible for their preparation. The shop drawings will be reviewed for design intent only. Engineering and detailing shall be solely the responsibility of the manufacturer and the professional engineer responsible for their preparation.
8. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.

1.6 INFORMATIONAL SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

B. Fabricator shall participate in the certified Quality Certification Program and shall submit, at the completion of fabrication, a certificate of compliance stating that the work was performed in accordance with the approved construction documents.

C. Metal Building System Certificates: For each type of metal building system, from manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

a. Name and location of Project.
b. Order number.
c. Name of manufacturer.
d. Name of Contractor.
e. Building dimensions including width, length, height, and roof slope.
f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
g. Governing building code and year of edition.
h. 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).

i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
j. Building-Use Category: Indicate category of building use and its effect on load importance factors.

2. IAS Certification: Copy of IAS certification.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed pre-engineered building structure work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating pre-engineered building structure similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in and be accredited by the International Accreditation Service, Inc (IAS) Inspection Programs for Manufacturers of Metal Building Systems, AC472.

C. 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.

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the State of Kentucky and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 360 “Specification for Structural Steel Buildings.”
2. AISC 303 “Code of Standard Practice for Steel Buildings and Bridges.”
3. AISC Design Guide 7 “Industrial Buildings – Roofs to Anchor Rods”, Second Edition.
4. Research Council on Structural Connections’ (RCSC) “The Specification for Structural Joints Using High-Strength Bolts, 2009.”
5. American Welding Society’s (AWS) D1.1-2010 “Structural Welding Code – Steel.”
6. ASTM A 6 “Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.”
7. AGA – American Galvanizers Association publication “Recommended Details for Galvanized Structures”.
8. AWS – “AWS Standard for Certification AWS Certified Welders” AWS QC7-93.
9. AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
10. SSPC – Steel Structures Painting Manual, Volume 1 and 2, latest edition.
11. SSPC Surface Preparation Specification, SP1 through SP15.

F. Welding Standards: Comply with applicable provisions of AWS D1.1 “Structural Welding Code – Steel.”

1.8 PROJECT CONDITIONS

A. Shop Drawings: Comply with established column layout and grid, column base elevation, and frame type shown on the Drawings establishing foundation dimensions.

B. Established Dimensions for Foundations: Install anchor rods per established dimensions on approved anchor-bolt plans, proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver pre-engineered building structure components to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. A&S Building Systems, Inc.; Division of NCI Building Systems,L.P.
2. American Steel Building Co., Inc.
3. Butler Manufacturing Company; a BlueScope Steel company.
4. Ceco Building Systems; Division of NCI Building Systems, L.P.
5. Chief Buildings; Division of Chief Industries, Inc.
6. Gulf States Manufacturers, Inc.; Division of Magnatrax Corp.
7. Kirby Building Systems; Division of Magnatrax Corp.
8. Metallic Building Company; Division of NCI Building Systems, L.P.
9. Nucor Building Systems.
10. Star Building Systems; an NCI company.
11. USA, Inc.
12. VP Buildings; a United Dominion company.

2.2 SYSTEM DESCRIPTION

A. Description: Provide a complete, integrated set of metal building system manufacturer's standard 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 Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, 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.
2. Primary framing to be prime painted.
3. 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.

C. Endwall Framing: Endwall framing shall include the corner columns and endwall columns and wind girts, and shall be manufactured of I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet according to the following:

1. Structural members to be prime painted . All cold- or roll-formed sheet (gauge) material to be galvanized with clear acrylic secondary coating.
2. Load-bearing end-wall and corner columns with rafters capable of supporting the tributary one-half bay design load. Lateral X-bracing of rods are permitted where shown.

D. 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, steel sheet to comply with the following:

1. Structural members to be galvanized. All cold- or roll-formed sheet (gauge) material to be galvanized with clear acrylic secondary coating.
2. Wall spandrel beams to provide lateral out-of-plane support for perimeter masonry walls. Wall spandrel beams shall be provided full perimeter of the building spaced 16 feet on center maximum vertically. Where overall wall height exceeds 18 feet provide additional spandrels at top of wall. Spandrel beams shall be designed to resist wind and seismic loading applied from the walls. Spandrel beams to be I-shaped sections fabricated from structural-steel shapes or shop-welded, built-up steel plates or closed tube sections. Open wide flange sections shall be designed with interior flange as unbraced for compression stresses.
3. Wall girts shall be nominal 8” deep “C” or “Z” shaped members fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form edges of sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch wide flanges. Design as simple span, continuous, or partially continuous for the specified loads. Wall girts shall be fabricated to be run outside the primary frame columns
4. Roof purlins shall be manufacturer’s standard depth “C” or “Z” shaped members fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form edges of sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch wide flanges. Design as simple span, continuous, or partially continuous for the specified loads.
5. 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.
6. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary-frame flanges.
7. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
8. Base or Sill Angles: Minimum 3-by-2-inch (76-by-51-mm) zinc-coated (galvanized) steel sheet.
9. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
10. Secondary End-Wall Framing: Manufacturer's standard sections.
11. 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.

12. 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.
13. Wind bracing shall be a system of diagonal cable bracing. Unless otherwise noted, column bases shall be designed as pinned as to not transfer moment into the foundations.
14. Metal roofing shall be assumed to have zero capacity for diaphragm action. Cable or rod bracing shall be utilized in the plane of the roof to transfer lateral loads into the primary and secondary frames.

E. Column Type
1. Tapered column.

F. Bay Spacing: As shown.

G. Eave Height: As shown.

H. Roof Slope
1. Dual slope as shown on drawings.

2.3 MATERIALS

A. All structural steel shapes shall be new, unused and perfect stock, free from millscale, rust, flake, pitting, and imperfections, without bends, kinks, and distortions.

B. Wide Flange and Tee Shapes (Designated as W and WT): ASTM A36 or ASTM A992.

C. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36.

D. Plates and Bars: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.

E. Cold-Formed Structural Steel Tubing: ASTM A500, Grade B.

F. Steel Pipe: ASTM A53, Grade B.

G. Structural-Steel Sheet: Hot-rolled, ASTM A 1011, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008, Structural Steel (SS), Grades 25 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70. hot dip galvanized.

H. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process with clear acrylic to comply with ASTM A 755.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, Structural Steel (SS), Grades 33 through 80; or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G30 coating designation.

I. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153, Class C**.**

J. High-Strength Bolts, Nuts, and Washers: ASTM A325 or A490, Type 1, heavy hex steel structural boltsor tension-control, bolt-nut-washer assemblies with spline ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.

1. Finish: Plain

K. Welding Electrodes: Comply with AWS requirements.

2.4 PRIMER

A. Primer: SSPC-Paint 15.

2.5 GALVANIZING MATERIALS

A. Galvanizing: The zinc used for the coating shall conform to the specifications for slab zinc (Spelter) ASTM designation: B6.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds and repair painting of galvanized steel, with dry film containing not less than 93 percent zinc dust by weight and complying with DOD-P-21035 A or SSPC-Paint 20, Type II.

PART 3 - EXECUTION

3.1 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.
3. Anchor rods shall not be located closer than 4” to any edge of concrete from centerline of rod.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Fabricate and assemble pre-engineered building structure in shop to greatest extent possible.

D. Fabricate building structure components exposed to view with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating and shop priming.

E. 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.

F. 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.

3.2 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar other than column bases. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 “Hand Tool Cleaning,” all steel except as otherwise specified.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer’s instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.0 mils (0.025 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

3.3 GALVANIZING

A. All welded assemblies to be galvanized shall be prepared according to Recommended Practice for Providing High Quality Zinc Coatings (Hot-Dip) on Assembled Products (ASTM A385).

B. Steel shall be thoroughly cleaned by solvent cleaning in accordance with latest edition of Steel Structures Painting Council “Surface Preparation Specification No. 1 (SSPC-SP1).

C. Steel shall be hot-dip galvanized in accordance with ASTM A123.

D. Hardware and threaded fasteners shall be galvanized in accordance with ASTM A153.

E. Safeguard products against steel embrittlement according to ASTM A143.

F. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

G. Coating weight shall conform with paragraph 5.1 of ASTM A123 or Table 1 of ASTM A153, as appropriate.

H. Surface finish shall be continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.

I. Adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.4 EXAMINATION

A. Before erection proceeds, and with the erector present, verify elevations of concrete bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.5 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep pre-engineered building structure secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent building structure, connections, and bracing are in place, unless otherwise indicated.

3.6 ERECTION

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Set pre-engineered building structure accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

C. Maintain structural stability of frame during erection.

D. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

E. Base 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.

F. 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.

G. 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 according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.

H. 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. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

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. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.7 QUALITY CONTROL

A. General: The Owner will engage an independent testing and inspecting agency to perform inspections and tests and to prepare test reports. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements. Failure to detect any defective materials shall not prevent later rejection when such defect is discovered, or obligate the Architect or Owner for final acceptance.

1. See Section 014110 – Structural Special Inspections for testing and inspection to be performed.
2. Provide access for testing agency to places where structural framing work is being installed so that required inspection and testing can be accomplished.
3. The General Contractor shall provide the testing agency a complete set of approved shop drawings.
4. Reports will be delivered to the Architect, Engineer, and the General Contractor within one week of inspection.
5. Deviations from requirements of the contract documents will be reported in writing to the General Contractor within 24 hours.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

3.8 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A780. Minimum thickness requirements for the repair are those described in ASTM A123, Section 4.6.

END OF SECTION 13341

SECTION 15010

GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals necessary to provide a complete and operational HVAC system as shown on the Drawings and as specified herein.

B. Installation of equipment that has not been specifically detailed in the Drawings shall be installed per that equipment manufacturer's recommended installation instructions or industry Standard Methods. All hardware and materials required for said equipment installation shall be included in the bid price.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Divisions 0 and 1 Specification sections, apply to work of this section. Additional work incidental to the HVAC System work shall be done under other Sections of the Specifications. Carefully review the entire contents of the bidding documents.

1.03 PROTECTION OF MATERIALS, WORKS, AND GROUNDS

A. Materials, fixtures, and equipment shall be properly protected and all pipe openings shall be temporarily closed so as to prevent obstruction and damage.

B. Protect and preserve all materials, supplies, and equipment of every description and all work performed. Damages shall be repaired or replaced promptly at no additional cost to the Owner.

1.04 CLEANING

A. During the progress of the work, clean up and remove all oil, grease, and other debris. At completion, clean all equipment, piping, and duct systems, remove all stickers, non-permanent tags, and leave work in perfect operating condition.

1.05 DRAWINGS

A. All work shown on the Drawings is intended to be approximately correct to scale, but figures, dimensions, and detailed drawings are to be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of pipes and ducts and methods of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the Drawings, all necessary parts to make complete working systems ready for use shall be furnished without extra charge. All work shall be installed in such a manner to avoid being unsightly.

B. Locations of equipment and piping shown on the Drawings are approximate, and it is intended that all equipment shall be located in accordance with the general and detail Drawings of the construction

proper. All measurements shall be taken at the site. UTILIZE ONLY DIMENSIONED ARCHITECTURAL DRAWINGS FOR LAYING OUT WORK. SCALING OF DRAWINGS FOR FIELD WORK IS UNACCEPTABLE.

1.06 CODES, ORDINANCES, STANDARDS

A. The minimum standard for all work shall be the latest revision of the Kentucky Building Code (KBC) and its references. Whenever and wherever state laws and/or regulations and/or the Engineer's design requires a higher standard than the current Code, then these laws and/or regulations and/or the design shall be followed.

B. Contractor's performing HVAC work shall be licensed in the State of Kentucky.

1.07 FEES/PERMITS

A. Contractor shall be responsible for all permit fees unless otherwise noted.

B. Obtain all required permits, pay all fees for the same, and in general, take complete charge and responsibility for all legal requirements pertaining to this Section of the work.

1.08 LABELING

A. All mechanical equipment and items utilizing electrical components shall be UL or ETL listed for the application, where a listing exists. Other code accepted independent testing laboratory certification will be accepted as equivalent to UL.

1.09 COOPERATION WITH OTHER TRADES

A. The work will be so performed that the progress of the entire building construction including all other trades, shall not be delayed nor interfered with. Materials and apparatus shall be installed promptly when and as desired.

B. Confer with all other trades relative to location of all apparatus and equipment to be installed and select locations so as not to conflict with work of other Sections. Refer to the General Conditions for Dispute Resolution Requirements. All work and materials placed in violation of this shall be readjusted to the Engineer's satisfaction at no expense to the Owner.

C. Where work of this Section will be installed in close proximity to work of other Sections or where there is evidence that the work of this Section will interfere with work of other Sections, assist in working out space conditions to make satisfactory adjustment. If so directed, prepare and submit for approval 1/4-inch scale or larger working drawings and sections, clearly showing how this work is to be installed in relation to the work of other Sections. If the work of this Section is installed before coordinating with other trades or so as to cause interference with work of other trades, make changes necessary to correct conditions without extra charge.

1.10 REVIEW OF MATERIALS

A. The Engineer shall be notified by letter one week after the preconstruction meeting of any materials that have a delivery lead time of over six weeks.

1.11 SUBMITTALS

A. Submit to the Engineer for review, as provided in the General Conditions, the manufacturer's shop drawings and technical literature covering details and installation of all new equipment, fixtures, and accessories being furnished under this Section prior to fabrication, assembly, or shipment.

B. Shop drawings will be required on all materials specified throughout individual Sections of this Division. Refer to individual technical sections for additional submittal requirements.

C. Shop drawings shall be submitted only after the Contractor has checked and verified all field measurements, quantities, equipment dimensions, specified performance criteria, installation requirements, electrical requirements, materials, catalog numbers, and similar data with respect thereto and reviewed or coordinated each shop drawing with the requirements of the work and the Contract Documents.

D. At the time of each submission the Contractor shall give the Engineer specific written notice of each variation that the shop drawings may have from the requirements of the Contract Documents.

E. The shop drawings shall have a stamp or specific written indication that Contractor has satisfied the requirements stated herein before. Shop drawings submitted without the Contractor's review stamp shall be immediately returned to the Contractor without the Engineer's review.

1.12 OPERATING AND MAINTENANCE MANUALS

A. Three sets of O&M instructions and manuals shall be submitted in loose-leaf 3-ring cardboard reinforced vinyl binders to the Engineer in accordance with the General Conditions. A PDF copy is also required to be submitted.

B. Contained in each binder shall also be vendors, warranty information, vendor phone numbers, list of materials, and materials parts list.

1.13 POWER SUPPLY

A. Refer to Division 16 and the Contract Drawings (except as noted herein).

1.14 SITE VISIT

A. It shall be the responsibility of the bidder to visit the site before submitting his bid, and thoroughly note the conditions under which the work will be installed. No extra compensation will be later allowed for necessary work not figured that should have been foreseen.

1.15 ACCEPTANCE

A. After the various systems are completed and at which time the Engineer shall deem appropriate, the Contractor shall run an operation test for acceptance of each system. The Contractor shall adjust all valves, equipment, controls and accessories so as to obtain maximum operating efficiency. Failure of any component to perform as specified shall constitute cause for rejection and removal. The

Contractor shall instruct the Owner's representative in the operation of the system. See individual technical sections for additional requirements.

1.16 NOISE AND VIBRATION

A. Install vibration isolators, flexible connectors, expansion joints, and other safety measures to prevent noise and vibration from being transmitted to occupied areas. Equipment shall be selected to operate within the noise level recommended for the particular type installation in relation to its location.

B. Following installation, make proper adjustments to eliminate excessive noise and vibration.

1.17 OWNER TRAINING

A. All manufacturers supplying equipment for this division shall provide the Owner's operations staff with training in the operation and maintenance on the equipment being furnished. The training shall be conducted at the project site by a qualified representative of the manufacturer.

B. The cost of this training shall be included in the bid price.

C. The required training shall consist of both classroom and hands-on situation. Classroom training shall include instruction on how the equipment works, its relationship to all accessories and other related units, detailed review of shop drawings, detailed presentation of written O&M instructions, troubleshooting and record-keeping recommendations. Hands-on training shall include a review of the manufacturer's O&M instructions, check out of each operators identifying key elements of the equipment, tear down as appropriate, calibration, adjustment, greasing and oiling points, and operating manipulations of all electrical and mechanical controls.

D. The training shall be scheduled through the Contractor with the Owner. The timing of the training shall closely coincide with the startup of the equipment, but no training shall be conducted until the equipment is operational.

E. The minimum number of training hours to be provided by manufacturers supplying equipment on this project are noted in the individual Specification Sections for said equipment.

F. At least 14 days prior to the training the manufacturer shall submit through the Contractor to the Engineer an outline of the training proposed for the Engineer's review and concurrence. The Owner reserves the right to videotape all training sessions.

1.18 RECORD DRAWINGS

A. The Contractor shall maintain 1 set of the Contract Drawings on the job in good condition for examination at all times. The Contractor's qualified representative shall enter upon these drawings, from day to day, the actual "as built" record of construction and/or alteration progress. Entries and notes shall be made in a neat and legible manner and these drawings delivered to the Engineer after completion of the construction, for use in preparation of Record Drawings.

1.19 WARRANTY

A. Contractor shall refer to the General Conditions for warranty requirements. Other items of equipment specified throughout Division 15 may have longer/special warranty requirements - see individual equipment specifications.

B. Repair and maintenance for the guarantee period is the responsibility of the Contractor and shall include all repairs and maintenance other than that which is considered as routine. (That is replacement of filters, oiling, greasing, etc.) The Engineer shall be the judge of what shall be considered routine maintenance.

1.20 SEISMIC CONSIDERATIONS

A. Refer to seismic category in Architectural Drawings and provide necessary supports and provisions to meet all applicable codes.

1.21 ENVIRONMENTAL

A. Contractor shall not use any materials that contain asbestos, lead, or PCB's.

1.22 COOPERATION

A. Cooperate with other trades to obtain the most practical arrangement of work. Become familiar with drawings before starting work.

B. Make known to other trades intended positioning of materials and intended order of work. Coordinate work with other trades and proceed with the installation to assure no delays to other trades. Determine intended positions of work of other trades and intended order of installation.

1.23 WORKMANSHIP

A. Work shall be performed only by mechanics and tradesman skilled and working within their respective trades and shall present appearance typical of the best trade practices. Work not installed in this manner shall be repaired, removed or replaced, or otherwise remedied at Contractor's expense as directed by Engineer.

1.24 ORDER OF WORK

A. Contractor shall organize work to cause least disturbance possible to operation of any building, service or system on site. When necessary to interrupt services, time of interruption shall be approved by Owner. Extras for differences between regular and overtime pay shall be allowed only when work is authorized to be accomplished at a time other than regular working hours. Work shall be scheduled to coincide with and cause the least possible disturbances to other contractor's work and schedules.

1.25 ACCESS DOORS TO EQUIPMENT

A. Access to mechanical equipment/devices that is located behind chases and above drywall ceilings that require maintenance or have electrical connections (requiring access in any way) shall be coordinated and included with the Architectural Trades. No extras will be allowed for the addition of access doors to such equipment. It is this Contractor's responsibility to ensure that access doors have been accounted for.

1.26 CONDENSATE DISPOSAL

A. Condensate piping shall be copper and shall be sloped ¼" per foot.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 15012
HVAC SUBMITTAL CHECKLIST

PART 1 - GENERAL

1.01 SUMMARY

A. This Section consolidates HVAC submittal requirements found in the Division 15 specification sections into checklist tables. The checklist is intended as an administrative control document and does not replace the detailed requirements of the referenced specification sections.

1.02 SUBMITTAL CHECKLIST TABLES

A. Qualifications and Certifications Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
15010	HVAC contractor license	With initial HVAC submittal		

B. Product Data/Shop Drawing Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
15190	HVAC Identification	Prior to procurement		
15760	Unit Heaters	Prior to procurement		
15784	Packaged Wallmount Heat Pump Units	Prior to procurement		
15830	Exhaust Fans	Prior to procurement		
15831	Air Circulators	Prior to procurement		
15850	Louvers	Prior to procurement		

C. Test Reports, Inspection Reports, Startup, and Commissioning Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
15010	HVAC system acceptance demonstration – AHJ Final Approval	Prior to substantial completion		
15760	Unit Heater Commissioning Report	After Installation		
15784	Wallmount Heat Pump Commissioning Report	After installation		
15830	Exhaust Fan Commissioning Report	After installation		

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
15831	Air Circulators	After installation		

D. Training Documentation Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
15784	Wallmount Heat Pump Training	After commissioning		
15831	Air Circulators	After commissioning		

E. O&M Manuals, Record Drawings, & Closeout Documentation

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
15010	Red-lined Record Drawings	At substantial completion		
15010	HVAC O&M Manuals for 15760, 17380, 15850	At substantial completion		
15784	Wallmount Heat Pump O&M manuals	At substantial completion		
15831	Air Circulator O&M manuals	At substantial completion		

F. Spare Parts Delivery Documentation

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
15784	Spare Filters	At substantial completion		

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 15190

HVAC IDENTIFICATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes HVAC identification materials and devices.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.

1. Product data for identification materials and devices.

1.04 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices after completion of covering and painting where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. Where more than single type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate permanently fastened to equipment and having data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: An accessible and visible location.

C. Plastic Equipment Markers (Heat Pumps, Air Handlers, Condensing Units, Pumps, Chillers): Laminated-plastic, Size: Approximate 2-1/2 by 4 inches for control devices, dampers, and valves; and 4-1/2 by 6 inches for equipment.

D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated on the Drawings. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

PART 3 - EXECUTION

3.01 LABELING AND IDENTIFYING

A. Equipment Labeling

1. Provide equipment labels on all mechanical equipment that is individually tagged on the Drawings.

2. Provide equipment labels on all equipment with electrical service regardless of whether or not the equipment is tagged on the Drawings. The equipment label shall bear the same name as the circuit breaker label that serves the equipment. This labeling requirement applies to all equipment on the project regardless of what Division it is furnished under.

END OF SECTION

SECTION 15760

UNIT HEATERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install the unit heaters as indicted on the Drawings and as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Electrical Requirements: Division 16

B. Basic HVAC Requirements: Section 15010

C. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 0 and 1 Specification sections, apply to work of this section.

1.03 SUBMITTALS

A. Submit manufacturer's technical product data, assembly-type shop drawings, ladder-type wiring diagrams differentiating between portions of wiring that are factory- installed and portions to be field-installed, and maintenance data. Comply with the requirements of General Requirements and Special Conditions of these specifications.

B. Provide a testing/commissioning report as specified herein.

1.04 OPERATING AND MAINTENANCE MANUALS

A. Three sets of O&M instructions and manuals shall be submitted in loose-leaf 3-ring cardboard reinforced vinyl binders to the Engineer in accordance with the General Conditions. O & M manuals shall be submitted in PDF format along with the required paper copies.

B. Contained in each binder shall also be vendors, warranty information, vendor phone numbers, list of materials, and materials parts list.

C. O & M Manuals shall be available to the Owner prior to equipment training commences.

D. General and Supplemental General Conditions shall supercede this paragraph where conflicts occur.

PART 2 - PRODUCTS

2.01 ELECTRIC UNIT HEATERS

A. General: Provide unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Horizontal Unit Heaters: Construct casings of steel, phosphatized inside and out, and finished with baked enamel. Provide motor-mounted panel, minimum of 18-ga steel. Fabricate casing to enclose coil, louvers, and fan blades. Provide louvers for 4-way air diffusion. Construct fans of aluminum, and factory-balance. Provide fan inlet orifice, smooth, and drawn into casing back panel.

C. Coils: Construct of plate-type aluminum fins, mechanically bonded to copper tubes. Design coil for use in steam or hot water applications.

D. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

E. Manufacturers: Markel, Airtherm; Buffalo Forge; Dunham-Bush; McQuay; Modine; Trane; Wing; Reddi; Qmark; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install unit heaters as indicated, and in accordance with manufacturer's installation instructions. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated. Support units with rod-type hangers anchored to building substrate. Install piping as indicated. Protect units with protective covers during balance of construction.

3.02 ADJUSTMENT AND CLEANING OF TERMINAL UNITS

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

3.03 TESTING/COMMISSIONING

A. Provide commissioning of each heater. Check for proper operation of fan and remote thermostat. Measure and record voltages and amp draw on each phase. Record model and serial number on each unit and submit startup/commissioning report.

END OF SECTION

SECTION 15784

PACKAGED WALLMOUNT HEAT PUMP UNITS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes packaged wall-mounted heat pump units and their accessories and controls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. Product Data: Include rated capacities, weights, furnished specialties, and accessories for each model indicated.

B. Shop Drawings: Provide specifications/product data, detail equipment dimensions, wall penetration dimensions, and wiring diagrams. Also provide a color chart with at least (5) color options for Owner color selection, and proposed warranty information.

C. Shop Drawing submittal shall include proposed lintel and girt details based on the equipment selected.

D. Operation & Maintenance Data: Provide O&M manuals.

E. Test & Balance Report

F. Training Report

1.04 QUALITY ASSURANCE/WARRANTIES

A. Unit performance shall be certified in accordance with ARI standard 390 for vertical single package heat pumps. Electrical system shall be either UL or ETL listed to the latest ANSI standard for Safety for Heating and Cooling Equipment. It shall also be NEC/NFPA 70 compliant.

C. A manufacturer 5-year (minimum) warranty certification is required.

D. Unit shall comply with the latest Mechanical & Energy codes in effect.

1.05 COORDINATION

Coordinate layout and installation of units and wall construction where unit penetrates wall or is supported by it.

1.06 SPARE PARTS

A. Provide a box of minimum five (5) spare filters

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bard
2. Marvaire
3. Or Equal

2.02 MANUFACTURED UNITS

A. Description: Packaged, self-contained, wall-mounted heat pumps with electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil. Heat pump can operate in heating or cooling mode.

B. Cabinet: 20 gauge galvanized steel painted and capable of resisting a 1000 hour salt spray exposure per ASTM B117.

1. Mounting: Wall with integral side mounting brackets.
2. Finish: Baked enamel with polyurethane primer. The color shall be as selected by Owner during submittal review.

C. Refrigeration System: Direct-expansion copper tube coil with aluminum fins and capillary restrictor, hermetically sealed compressor with internal spring isolation, and overload protection. Refrigerant shall be R-454B.

D. Air System: Forward-curved, centrifugal, indoor fans with permanent-split-capacitor motor and throwaway filters.

E. Outdoor Fan: Propeller type with separate permanent-split-capacitor motor.

F. Filter – Provide 1 inch throwaway filter.

G. Electric Resistance heating: Electric supplemental heaters shall be provided of the capacity as indicated on the Drawings. Each heater shall be equipped with an automatic reset limit switch and a one-time high temperature thermal cutout for additional safety back up protection.

H. Efficiency: The efficiency of the unit shall be compliant with the latest Energy Code in effect, but not less than 11.0 EER (cooling mode) and 3.3 COP (heating mode) at ARI standard conditions.

I. Ventilation: The unit shall include a motorized fresh air damper.

2.03 CONTROLS

A. Controls: Provide a digital, programmable lead/lag controller with built-in temperature sensor that will alternate two units. The controller shall have relay output contacts for alarm signal connections.

B. Provide low Ambient Control to allow cooling cycle operation down to 0°F.

C. Shall include an alarm relay to provide signal upon a condition of shutdown on either high or low-pressure controls.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units according to manufacturer's written instructions.

B. Provide a lintel to support the masonry above each duct penetration.

C. Provide girts where necessary for structural stability of the wall.

D. Supply and return openings shall be ducted with painted G90 sheet steel from the heat pump unit to the register.

3.02 CONNECTIONS

A. Condensate Drain: Pipe to grade level. Ensure that grade is sloped away from building.

B. Electrical: Connect units to wiring systems and to ground as indicated and instructed by manufacturer.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 CLEANING

After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

3.04 COMMISSIONING

A. After installation, check the following:

1. Unit casing has no visible damage.

2. Compressor, air-cooled condenser coil, and fans have no visible damage.

3. Labels are clearly visible.

4. Controls are connected and operable.

5. Shipping bolts, blocks, and tie-down straps are removed.

6. Filters are installed and clean.

7. Drain line is installed correctly.

B. Lubricate bearings on fan.

C. Check fan-wheel rotation for correct direction without vibration and binding.

D. Start unit according to manufacturer's written instructions. Complete manufacturer's startup checks. Provide amp draw and voltage measurements on each phase with emergency heat on and off.

E. Provide balancing and ventilation damper adjustment. Refer to the schedule on the Contract Drawings and balance to within 10% of specified ventilation. Test the supply and return airflow and confirm within unit specifications. Submit test and balance report to Engineer.

F. After starting and performance test, change filters.

3.05 TRAINING

A. Subsequent to commissioning, provide training of Owner personnel on system operation and maintenance. Submit report of training curriculum and attendance.

- END OF SECTION -

SECTION 15830
EXHAUST FANS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes propeller sidewall exhaust fans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound power ratings.

3. Motor ratings and electrical characteristics plus motor and electrical accessories.

4. Material gauges and finishes, including color charts.

5. Dampers, including housings, linkages, and operators.

C. Provide testing/commissioning report as specified herein.

1.04 OPERATING AND MAINTENANCE MANUALS

A. Three sets of O&M instructions and manuals shall be submitted in loose-leaf 3-ring cardboard reinforced vinyl binders to the Engineer in accordance with the General Conditions.

B. Contained in each binder shall also be vendors, warranty information, vendor phone numbers, list of materials, and materials parts list.

C. O & M Manuals shall be available to the Owner prior to equipment training commences.

D. General and Supplemental General Conditions shall supercede this paragraph where conflicts occur.

E. O & M manuals shall be submitted in PDF format along with the required paper copies.

1.05 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

1.06 PERFORMANCE REQUIREMENTS

A. Fan Unit Schedule: The following information is described in an equipment schedule on the Drawings.

1. Fan performance data including capacities, outlet velocities, static pressures, motor requirements, and electrical characteristics.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Ventilators:

a. Cook (Loren) Co.
b Greenheck Fan Corp.
c. ILG Industries, Inc.
d. Jenn Industries Inc.
e. Or Equal

2.02 PROPELLER SIDEWALL FANS – DIRECT DRIVE

A. Fan shall be direct-driven, axial type sidewall fan with fabricated steel blades and hubs. Propellers shall be securely attached to fan shafts. All propellers shall be statically and dynamically balanced.

B. Motors shall be permanently lubricated, totally enclosed, heavy-duty type, non-overloading over the complete fan curve, and of the scheduled voltage and phase.

C. Fan shafts shall be ground and polished and mounted in permanently lubricated sealed ball bearing pillow blocks. Bearings shall be selected for a minimum life in excess of 100,000 hours at maximum speed. Drives shall be sized for a minimum of 150 percent of driven horsepower.

D. Drive frame and panel assemblies shall be painted steel. Drive frames shall be formed channels and fan panels shall have prepunched mounting holes, formed flanges, and a deep formed inlet venturi. Drive frames and panels shall be of welded construction.

E. The axial fan shall bear the AMCA Certified Ratings Seals for both sound and air performance.

F. Provide wall housing and wire safety guard.

G. Provide electrical disconnect with single point wiring connection.

H. Provide motorized backdraft damper. Damper shall include an end/limit switch to signal when the damper is fully open.

I. Provide a weatherhood of painted steel. A birdscreen shall be included.

J. See Schedule on Drawings for additional requirements.

K. Finish shall be Hi-Pro Polyester. Submit color chart for Owner color selection during submittal review.

L. Motors shall be inverter-duty.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install power ventilators according to manufacturer's written instructions.

B. Install units with clearances for service and maintenance.

C. All fasteners for fans, vents, etc. shall be constructed of non-ferrous type 316 stainless steel.

3.02 TESTING/COMMISSIONING

A. Provide commissioning of each fan. Check rotation confirm associated louver operation. Record voltages and amp draw on each phase. Provide instrumentation and measure airflow at low and high speeds. Coordinate with VFD supplier and set the low-speed setting to achieve the specified low flow mode cfm.

B. Submit a commissioning report along with the O&M manual documenting the above information and fan information such as model and serial number.

END OF SECTION

SECTION 15831

AIR CIRCULATORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes high-volume, low-speed (HVLS), large-diameter industrial ceiling fan assemblies, controllers, mounting hardware, safety cables, airfoils, electrical connections at fan, testing, startup, and owner instruction. Basis-of-design product: Big Ass Fans, Powerfoil D HVLS fan, or approved equivalent meeting this Section.

B. Section also includes high-speed destratification fans and their associated controllers, mounting hardware, safety cables, electrical connections, testing, startup, and Owner instruction. Basis of design product: Big Ass Fans Hornet fan, or approved equal meeting this Section.

1.02 REFERENCES

A. AMCA 230 - Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.

B. NFPA 70 - National Electrical Code.

C. UL 507 - Electric Fans.

D. Manufacturer installation instructions, technical specification sheet, and warranty terms for the specific model and diameter furnished.

1.03 COORDINATION

A. Coordinate fan locations, diameters, extension tube lengths, and mounting types with structural framing, lights, equipment, and obstructions.

B. Verify structural support is adequate for fan weight, dynamic loads, safety cable anchorage, guy wires, seismic requirements, and other project-specific loads. Do not attach fans to roof deck or unsupported framing.

C. Coordinate required airfoil clearances to ceilings and major obstructions. Minimum clearances shall be not less than manufacturer requirements for fan diameter.

1.04 SUBMITTALS

A. Product data: Model numbers, fan diameter, weights, maximum speed, motor horsepower, input voltage/phase, breaker requirements, sound rating, IP ratings, controls, accessories, finishes, warranty, and installation limitations.

B. Structural attachment verification: Calculations or written certification by a qualified professional engineer licensed in the project jurisdiction

C. Operation and maintenance data, final as-built fan schedule, controller instructions, startup report, warranty documentation, and spare parts list.

1.05 QUALITY ASSURANCE

A. Installer qualifications: Manufacturer-certified installer or experienced installer acceptable to manufacturer and Owner.

B. Electrical components and installation shall comply with NFPA 70 and local codes.

C. Provide fans UL listed and labeled.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer original packaging with labels intact.

B. Store indoors in clean, dry area protected from weather, water, dust, construction debris, and physical damage.

C. Handle airfoils and controller assemblies to avoid bending, scratching, impact damage, and contamination.

1.06 WARRANTY

A. Provide 7 year warranty on the HVLS fan and 5 years on the destratification fan.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-design manufacturer: Big Ass Fans, Lexington, Kentucky

B. Or Equal Substitutions: Submit under Division 01. Equivalent products shall meet or exceed airflow, safety, mounting, environmental, controls, warranty, and service requirements of this Section. Substitution requests shall include side-by-side comparison to basis-of-design product and project-specific layout impacts.

2.02 HVLS FAN ASSEMBLY

A. Type: Gear-driven, high-volume, low-speed, ceiling-mounted industrial air circulator with variable speed control.

B. Diameters: Provide fan diameters indicated on Drawings and schedule.

C. Environment: Indoor

D. Ingress protection: Fan motor and drive shall be rated IP66; controller shall be rated IP55.

E. Airfoils: Six custom-engineered aluminum airfoils with winglets; provide airfoil retention/restraint system required for fan size and application.

F. Drive: Provide permanent magnet motor and onboard variable frequency drive (VFD).

G. Safety features: Double safety cable system, airfoil retainers, hub safety clips, Grade 8 hardware, fire relay/shutdown interface, guy wires where required by extension tube length, and airfoil restraint system.

H. Mounting: Refer to the Drawings and coordinate with pre-engineered metal building manufacturer. Provide kits for solid beams or purlins, or other structural conditions as required. Submit mfr-authorized proposed mounting arrangement in the shop drawing submittal.

I. Accessories: Provide accessory kit necessary to allow multiple fans to be controlled from a single controller. A single Bafcon controller is required to control both fans.

2.03 DESTRATIFICATION FANS

A. Provide Big Ass Fans Hornet, or equal. Each fan shall include a heavy-gauge steel frame with 30" fan diameter, steel spiral bottom guard, vibration damping HDPE housing, steel suspension cable system, IP-55 1/3HP motor with integral VFD suitable for 120VAC power supply, and max speed of 1302 RPM. Fan shall be rate for operation up to 104°F. Shall include a 10 foot power cord, on-off switch control, stability kit, and top-guard kit. The fan shall supply 5796 cfm at max speed with minimum efficiency of 15.8 cfm/watt at max speed.

2.04 CONTROLS

A. Provide BAFCon controller for each fan with 24-bit color LCD display, resistive touchscreen, and housing suitable for industrial use.

B. Controls shall be accessible to Owner and coordinated with mounting height, wall locations, conduit routing, and Division 16 requirements.

2.05 FINISH

A. Provide silver airfoils and yellow winglets for the HVLS fan. The destratification fan shall be black with yellow fan blades.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify structure, clearances, power, controls, and environmental conditions are acceptable before installing fans.

B. Confirm fan locations against approved shop drawings. Do not proceed where conflicts with, lights, obstructions, equipment, or structural limitations exist.

C. Notify Architect/Engineer of conditions that prevent proper installation. Beginning installation indicates acceptance of substrate and conditions.

3.02 INSTALLATION

A. Install fans in accordance with manufacturer written instructions, approved shop drawings, NFPA 70, and applicable codes.

B. Install upper mount, extension tube, fan assembly, airfoils, airfoil retainers, safety cables, guy wires, controller, and accessories as required by manufacturer.

C. Tighten fasteners to manufacturer published torque values. Use manufacturer-provided Grade 8 hardware unless otherwise approved by manufacturer.

D. Install safety cables tightly around approved structural members with minimal slack. Do not rely on nonstructural building elements for support.

E. Install guy wires when required by manufacturer, including where extension tube length is 4 ft or longer unless manufacturer states otherwise for the actual configuration.

F. Connect electrical power, grounding, controller, and interface wiring in accordance with approved wiring diagrams and Division 16 requirements.

G. Maintain clearances from fan blade/winglet tips to ceiling, lights, racks, and other obstructions as required by manufacturer and authorities having jurisdiction.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's authorized representative shall inspect installation before startup.

B. Verify fan rotation, speed control, controller functions, vibration, wobble, abnormal noise, and clearances.

C. Correct deficiencies, including loose hardware, improper clearances, unbalanced operation, wiring errors, controller faults, etc.

D. Submit written startup report identifying fan model, serial number, diameter, voltage, controller type, location, date tested, results, and corrective actions.

3.04 CLEANING AND PROTECTION

A. Clean exposed surfaces after installation. Remove packaging, labels not intended to remain, dust, debris, and fingerprints.

B. Protect installed fans and controllers from damage during remaining construction. Replace damaged components before Substantial Completion.

3.05 TRAINING

A. Train Owner personnel in startup, shutdown, speed adjustment, passcode/password functions, seasonal operation, cleaning, inspection, and maintenance. Onsite training session shall be provided.

B. Provide manufacturer operation and maintenance manuals, warranty documents, and service contact information.

END OF SECTION

SECTION 15850

LOUVERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment, and services required to furnish and install the louvers as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Electrical: Division 16

B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. Submit manufacturer's technical product data, assembly-type shop drawings, and maintenance data in conformance with General Conditions of these specifications.

1.04 QUALITY ASSURANCE

A. AMCA Compliance: Test and rate louvers and dampers in accordance with AMCA Standard 500, provide Certified Ratings Seal on each unit.

PART 2 - PRODUCTS

2.01 LOUVERS

A. Fabrication, General: Fabricate louvers and accessories to comply with requirements indicated for design (blade angle, blade profile, blade spacing), metal type and form, sizes, depth, arrangement, and metal thicknesses indicated or required for performance and use intended.

B. Structural Performance: Design, engineer, fabricate and install units capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of components, metal fatigue or noise from louver blade rattle or flutter, and permanent damage to fasteners or anchors.

1. Wind Load: Uniform pressure of 20 lb. per sq. ft., acting inwards and outwards.

2. Normal thermal movement from ambient temperature change (range) of 100 deg F and its effect on metal surfaces due to both solar heat and night time sky heat loss.

C. Preassemble units in shop.

D. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

American Warming and Ventilating Co.
Arrow United Industries
Greenheck Mfg. Co.
Ruskin Mfg. Co.
Vent Products
Or Equivalent

E. Combination Louver-Damper: Louvers shall be combination type with a drain gutter in each stationary blade and downspouts in jambs. Stationary blades and adjustable blades shall be contained within a single 6" louver frame. Adjustable section shall include low leakage blades and jamb seals. Louvers shall be extruded 6063-T5 aluminum alloy construction as follows:

1. Frame: 0.125" wall thickness, flanged

2. Blade: Stationary front section 0.081" wall thickness, approximate 37° angle on approximately 6" centers.

3. Seals: Extruded vinyl blade edge seals on rear adjustable blades and flexible, compressible aluminum jamb seals.

4. Linkage: Exposed.

5. Operator: Electric motor, 2-position action, 120 volt; spring return with integral spiral-spring mechanism; integral overload protection, and limit switch

6. Finish: 70% Kynar 500. Exterior custom color selection by Architect during shop drawing review.

7. Performance:

   a. Louver free area: approximate 45% free area

   b. Static pressure loss: 0.10 inch water gage max at 900 fpm

   c. Water penetration: 0.01 oz. per sq. ft at 1035 fpm

8. Bird Screen: 1/4" sq. mesh, 0.063 inch diameter, aluminum, inside mount

9. Manufacturer: Greenheck ECD-601 or equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install louvers in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Locate and place louver units plumb, level, and in proper alignment with adjacent work.

C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.

D. Form closely fitted joints with exposed connections accurately located and secured.

E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

F. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make the required alterations and refinish entire unit, or provide new units.

G. Protect nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metals.

H. All louvers shall be supplied by the same manufacturer.

I. Install electrical connections for power, controls, and devices.

J. Provide and coordinate flashing with masonry Contractor.

K. Provide epoxy coated steel flashing in openings where louvers do not totally cover all cut sides in masonry openings.

END OF SECTION

SECTION 16010

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work included in this section of the Specifications includes the furnishing of all labor, material, tools, approvals, excavation, backfill, and other equipment and services necessary to install the electrical system as shown on the Contract Drawings and as specified herein. It also includes the connection of all equipment included in this Contract but furnished by other contractors or suppliers.

B. The Contractor shall furnish and install all conduit, wire, safety switches and miscellaneous material to make all electrical connections to all items of equipment or wiring devices indicated in the Drawings or Specifications except as otherwise specified.

C. All devices and items of electrical equipment, including those shown on the Contract Drawings but not specifically mentioned in the Specifications or those mentioned in the Specifications but not shown on the Contract Drawings, are to be furnished under this section of the Specifications. Any such device or item of equipment, if not defined in quality, shall be equal to similar equipment and/or devices specified herein.

D. Bidders are required to visit the construction site prior to submitting a bid and carefully examine the Contract Drawings and Specifications so that he/she may fully understand what is to be done and to document existing conditions. Any discrepancies, questions, or omissions must be brought to the attention of the Engineer at least 10 days prior to the bid opening date. Extras will not be approved for work that the Contractor should have seen beforehand by visiting the site prior to bidding.

E. It is the general intent that all motors (except for replacement motors) shall be furnished with the particular object of equipment it drives by the supplier furnishing the equipment. Motor controls and related equipment shall be furnished by the Division 16 supplier unless specifically noted otherwise in these Specifications or on the Drawings.

F. Where wiring diagrams are not shown on the Contract Drawings, they shall be provided by the supplier of the equipment served and such diagrams shall be adhered to except as herein modified.

1.02 RELATED WORK

A. Division Zero and 1: Contractors bidding work under this Contract shall read and understand Division Zero and Division 1 - General Requirements. If any discrepancies are discovered between the Basic Electrical Requirements and the above-mentioned documents, the above-mentioned documents shall overrule this section. The Basic Electrical Requirements are intended as a supplement to the above-mentioned documents. The Contractor shall bid as outlined in the above mentioned Specifications and shall be governed by any alternates or unit prices called for in the form of proposal.

B. Contractor shall carefully examine the entire set of Contract Drawings and all Divisions of the Specifications.

1.03 SUBMITTALS

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted in the amount of copies per the General Conditions for this Division. All Shop Drawings shall be submitted in loose-leaf three-ring cardboard reinforced vinyl binders. A shop drawing submittal shall be prepared for each Section of this Division.

B. Shop Drawings shall be clearly marked and or highlighted as to which product, type, option, etc. is being submitted. Non-applicable catalog data shall be marked out. Product literature with one or more styles / configurations for a single product shall have a written description of use for each of the styles / configurations represented on the literature. For example: Device boxes – Styles shall be listed as: For masonry walls, for electrical devices, for ceiling mounted light fixtures, etc. Proposed options must be highlighted, underlined, etc.

C. The Engineer reserves the right to make modifications to motor control and power distribution equipment ratings after equipment Shop Drawing review, if the equipment Shop Drawings are submitted prematurely (prematurely meaning submitted before all utilization equipment has been reviewed and accepted). Cost of modifications shall be the Contractor's responsibility.

D. O&M manuals must be submitted for all equipment. The O&M manuals shall be assembled in three-ring binders with front and binder-edge labels. The first and last few pages shall have sheet hole protectors to prevent the pages from tearing out. O&M manuals must include the following information:

1. Vendor and contractor information, addresses, phone numbers, email, websites, etc.
2. Equipment cutsheets with detailed model number breakdown suitable for procuring replacement equipment. It is best to insert the approved shop drawing cutsheets into the O&M manuals, unless field changes necessitate otherwise. Non-applicable information must be marked out, and selected options must be highlighted.
3. Operation instructions
4. Maintenance instructions
5. Drawings, wiring diagrams, etc.
6. Copy of required testing results
7. Copy of inspection certificates
8. PDF format electronic copy of all O&M information.

E. AutoCAD floor plans are available in electronic format. Contact the Engineer to obtain these floor plans.

1.04 SYMBOLS AND ABBREVIATIONS

A. The symbols and abbreviations generally follow standard electrical and architectural practice; however, exceptions to this shall be as shown on the Contract Drawings.

1.05 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate the electrical work with that of other trades to ensure proper final location of all electrical equipment and/or connections. The Contractor shall verify door swings to see that light switches are located properly.

1.06 CODES

A. The minimum standard for all work shall be the latest revision of the Kentucky Building Code (KBC) and the National Electrical Code (NEC). Whenever and wherever state and/or local laws or ordinances and/or regulations and/or the Engineer's design require a higher standard that the current NEC or KBC, then these laws and/or regulations and/or the design shall be followed.

1.07 INSPECTIONS AND PERMITS

A. Inspection of the electrical system on all construction projects is required. It is the Contractor's responsibility to pay for and obtain all permits, pay all fees, and coordinate the activity of inspections. The Contractor shall notify the electrical inspector in writing, immediately upon notice to proceed, and a copy of the notice shall be submitted to the Engineer. No work shall be concealed unless acceptable to the inspector.

B. At the time of completion of the project, there shall be furnished to the Owner a certificate of compliance, from the agency having jurisdiction pursuant to all electrical work performed. The Engineer shall also receive a copy in the O&M manual submittal.

1.08 STORAGE

A. All work, equipment, and materials shall be protected against dirt, water, or other injury during the period of construction.

B. Sensitive electrical equipment such as light fixtures, motor starters, control panels, and panelboards, delivered to the job site, shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed. Electrical equipment other than boxes and conduit shall not be installed until the structure is under roof with doors and windows installed.

C. No light fixtures or device plates shall be hung or installed until after painting is completed.

1.09 ERRORS, CORRECTIONS, AND/OR OMISSIONS

A. Should a piece of equipment be supplied of a different size or horsepower than shown on the Contract Drawings, the Contractor shall be responsible for installing the proper size wiring, conduit, starters, circuit breakers, etc., for proper operation of that unit and the complete electrical system at no extra cost to the Owner.

B. It is the intent of these Specifications to provide for an electrical system installation complete in every respect, to operate in the manner and under conditions as shown in these Specifications and on the Contract Drawings. The Contractor shall notify the Engineer, in writing, of any omission or error at least 10 days prior to opening of bids. In the event of the Contractor's failure to give such notice, he/she may be required to correct work and/or furnish items omitted without additional cost. Further requirements on this subject may be found in the General Requirements.

C. Necessary changes or revisions in electrical work to meet any code or power company requirement shall be made by the Contractor without additional charge.

1.10 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee all work including equipment, materials, and workmanship. This guarantee shall be against all defects of the electrical system or improper equipment operation. It shall last for the period of time specified in the General Conditions of the Contract, but not less than one year from the date of substantial completion.

B. Repair and maintenance for the guarantee period is the responsibility of the Contractor and shall include all repairs and maintenance other than that which is considered as routine. (That is oiling, greasing, etc.) The Engineer shall be the judge of what shall be considered as routine maintenance.

C. Certain equipment is required to have longer warranty periods than that specified in the General Conditions. See the individual sections for these warranty requirements.

1.11 POWER COMPANY COORDINATION

A. Not applicable on this project.

1.12 TEMPORARY ELECTRICAL POWER AND LIGHTING

A. The Contractor shall be responsible for providing temporary electrical power and lighting as required during the course of construction and shall remove the temporary service equipment when no longer required. Temporary power is also addressed in general and special requirements.

1.13 TRAINING

A. All manufacturers supplying equipment for this division shall provide the Owner's operations staff with training in the operation and maintenance on the equipment being furnished. The training shall be conducted at the project site by a qualified representative of the manufacturer. Refer to individual equipment specifications for training requirements.

1.14 RECORD DRAWINGS

A. The Contractor shall maintain 1 set of the Contract Drawings on the job in good condition for examination at all times. The Contractor's qualified representative shall enter upon these drawings, from day to day, the actual record of construction and/or alteration progress. Entries and notes shall be made in a neat and legible manner and these drawings delivered to the Engineer after completion of the construction, for use in preparation of Record Drawings.

B. Specific attention shall be given to the exact location of any underground lines installed under this Contract. These lines shall be dimensioned to easily identifiable points on permanent structures.

1.15 MAINTAINING CONTINUOUS ELECTRICAL SYSTEM AND SERVICE

A. Existing water plant operation shall be maintained at all times. In no way shall the installation and/or alteration of the electrical work interfere with or stop the normal operation of the existing facilities, except where acceptable to the Owner and prior arrangements have been made.

B. When additions and taps to existing service(s) require electrical outages, arrangements shall be made in advance for such outages. All outages shall be held to an acceptable minimum with none exceeding 8 hours continuous duration. If necessary, cuts shall be performed on premium time. If performed at night, requiring a general outage, the Contractor shall furnish an auxiliary source of light and power as required. Under no circumstances shall an electrical outage of any duration be initiated until the Owner and Engineer have concurred, and as far as possible in advance.

1.16 CONTRACTOR LICENSING

A. The Contractor performing the electrical work on this project shall be a licensed electrical contractor in the state of Kentucky.

1.17 RECEIPTS

A. Some sections of the Specifications call for equipment, materials, accessories, etc. to be provided and "turned over to the Owner" or like requirements. The Contractor shall obtain a receipt for

each item turned over, signed by the Owner or his representative. A copy of this receipt shall be transmitted to the Engineer.

B. When a question arises concerning whether items have been turned over to the Owner, and there is no signed receipt, it may be assumed that the items were not provided.

1.18 DEFINITIONS

A. Furnish – Procure equipment/materials and deliver and unload at the project site.

B. Install – Enter the equipment/materials permanently into the project and make operational.

C. Provide – Furnish and Install

D. NEC – National Electrical Code

1.19 HAZARDOUS LOCATIONS

A. Electrical materials and equipment for installation in hazardous locations, as defined in the NEC and as indicated on the Drawings, shall be specifically approved by UL or FM for the particular Class, Division and Group of the location involved.

1.20 EQUIPMENT CONFIGURATION/PROGRAMMING

A. Any equipment furnished by the Contractor is required to be configured or programmed by the Contractor or his subcontractor/vendor. Any necessary studies or engineering necessary to configure or program this equipment shall be provided by the Contractor as needed to place the equipment into successful operation. Engineer or Owner will not be responsible for equipment configuration or programming. The exception to this is the DCC-GAC cabinet PLC and HMI, which will programmed by Owner's SCADA integrator.

B. If a manufacturer or manufacturer's representative is required to startup/commission the equipment in these Specifications, then it is required that the Contractor provide the services of the manufacturer to configure/program the equipment. This includes the provision of any necessary studies or engineering necessary for the configuration/programming.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials used shall be new and at least meet the minimum standards as established by the NEC and/or National Electrical Manufacturers Association (NEMA). All materials shall be UL listed for the application, where a listing exists. All equipment shall meet applicable FCC requirements and restrictions.

B. The reuse of salvaged electrical equipment and/or wiring will not be permitted unless specified herein or indicated on the Contract Drawings.

C. All salvaged or abandoned electrical materials shall become the property of the Contractor and shall be removed from the job site upon completion of the project, unless otherwise noted on the Contract Drawings or specified herein.

D. All materials must be rated for the temperature range expected to be encountered in the application indicated on the Drawings. If there are any questions regarding the temperature range, contact the Engineer 10 days prior to bid opening date. No extras will be allowed for materials proposed that do not have an acceptable temperature range.

2.02 OVERCURRENT AND OVERLOAD PROTECTION

A. Circuit breakers or fused switches shall be the size and type as written herein and shown on the Contract Drawings. Any additional overcurrent protection required to maintain an equipment listing by an authority having jurisdiction shall be installed by the Contractor at no extra cost to the Owner.

B. The Contractor shall submit actual nameplate data from motors shipped to the site, stating motor identification as well as characteristics. Overload relay thermal unit selection tables shall accompany the motor data. The Contractor shall select and highlight thermal unit sizes from this data and shall include this information in the O&M Manuals.

2.03 STEEL COVER PIPE

A. Steel cover pipe shall be furnished and installed as a sleeve to protect conduits that travel under roads or in boring/jacking installations. Pipe shall be plain end steel pipe with yield strength of 35,000 psi minimum and tensile strength of 60,000 psi minimum. It shall be manufactured per API-5L specifications. Minimum wall thickness shall be .188" under 10" size and .25" for 10" or 12" size.

2.04 POWER OUTAGE

A. All equipment provided shall restart automatically after a power outage is restored, unless specifically exempted by Engineer due to safety concerns.

PART 3 – EXECUTION

3.01 GENERAL ELECTRICAL INSTALLATION

A. Equipment connections shall be made with flexible or rigid conduit as required. Controllers for motors, safety switches, and all control, protective and signal devices for motor circuits, except where such apparatus is furnished mounted and connected integrally with the motor driven equipment, shall be installed, connected and left in operating condition. The number and size of conductors between motors and control or protective apparatus shall be as required to obtain the operation described in these Specifications, and/or by the Contract Documents, and/or as shown in manufacturer-furnished Engineer reviewed Shop Drawings.

B. All raceways and wiring shall be firestopped where required by code

3.02 CUTTING AND PATCHING

A. Cutting and patching shall be held to an absolute minimum and such work shall be done only under the direction of the Owner's representative. The Contractor shall be responsible for and shall pay for all openings that may be required in the floors or walls, and he shall be responsible for putting said surfaces back in their original condition. Every attempt shall be made to avoid cutting reinforcing steel bars when an opening is required in a reinforced concrete wall or floor slab.

B. Prior to cutting of any floors or walls, all conduits must be located prior to the cutting through the use of sounding test equipment. Such equipment is readily available through local electrical companies and other sources. If a pipe or electrical circuit is damaged during cutting/demolition the Contractor shall repair the damaged item back to original condition. Absolutely no extras will be allowed for the replacement of damaged electrical conduits, pipes, etc. in floors walls, and ceilings that are to remain.

3.03 CLEANUP

A. Cleanup shall be completed as soon as possible after the electrical installation is complete and as required throughout the project construction by the Owner. All equipment supplied under this Division shall be free of shipping tags, dust, stickers, shavings, filings, drill cuttings, etc. All painted equipment shall be left free of scratches or other blemishes, such as splattered or blistered paint, etc. Surplus material, rubbish and equipment resulting from the work shall be removed from the job site by the Contractor upon completion of the work. All existing equipment must be thoroughly cleaned by the Contractor in the vicinity of the construction area.

B. During construction, cover all Owner equipment and furnishings subject to damage or contamination in any way.

3.04 EXCAVATION AND BACKFILL

A. Excavation for conduits shall be of sufficient width to allow for proper jointing and alignment of the type conduit used. Conduit shall be bedded on original ground. Where conduit is in solid rock, a 6-inch earth cushion must be provided. Conduit shall be laid in straight lines between pull boxes and/or structures unless otherwise notes on the Contract Drawings. The cost of solid rock excavation shall be included in the lump sum bid with no extra pay allowed (unclassified).

B. Backfill shall be as detailed on the Drawings. Dirt within 6" of the conduits shall be hand placed, loose granular earth. It shall be free of rocks over ½ inches in diameter. Above 6", large rocks may be included but must be mixed with sufficient earth to fill all voids.

3.05 SLEEVES, CHASES AND OPENINGS

A. Sleeves shall be required at all points where exposed conduits pass through new concrete walls, slabs, or masonry walls. Sleeves that must be installed below grade or where subject to high water conditions must be installed watertight.

B. Wiring chases shall be provided where shown on the Contract Drawings. The Contractor shall have the option of installing chases below surface mounted panelboards provided all structural requirements are met.

C. It is the Contractor's responsibility to leave openings to allow installation of the complete, operational electrical system. Openings required but not left shall be cut as outlined under cutting and patching. The Contractor shall coordinate all holes and other openings with necessary diameters for proper firestopping.

3.06 GROUNDING AND BONDING

A. All metallic conduit, cabinets, equipment, and service shall be grounded in accordance with the latest issue of the National Electrical Code. All supporting framework and other metal or metal clad equipment or materials which are in contact with electrical conduit, cable and/or enclosures, shall be properly grounded to meet the code requirements.

3.07 ANCHORING/MOUNTING

A. Electrical conduits and/or equipment shall be rigidly supported. Anchors used shall be metallic expansion type, or if appropriate to prevent spalling concrete, epoxy set type. Plastic or explosive type anchors are prohibited.

B. Contractor shall provide all necessary supports in accordance with KBC Seismic requirements.

3.08 ELECTRICAL COMPONENT MOUNTING HEIGHTS

A. Unless otherwise indicated, mounting height for components shall be as defined on the Drawings.

3.09 TESTING

A. After the wiring system is complete, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for acceptance. The equipment shall be demonstrated to operate in accordance with the requirements of these Specifications and the Contract Drawings. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, as well as the necessary electrical power.

B. Before energizing the system, the Contractor shall check all connections and set all relays for proper operation. He/she shall obtain all necessary clearances, approvals, and instructions from the equipment manufacturers prior to placing power on the equipment.

C. Tests may be performed by the Engineer to determine integrity of insulation on wiring circuits selected by the Engineer at random.

D. Cost of utilities for testing done prior to beneficial occupancy by the Owner shall be borne by the Contractor.

3.10 BORING OR JACKING

A. Boring or jacking may be allowed at locations with permission of the Engineer. Boring or jacking shall be performed by mechanical means and accurate vertical and horizontal alignment must be maintained. Steel cover pipe shall be used and shall be installed inside bored holes concurrently with boring or jacking. All joints shall be solidly welded. The weld shall be such that the joint shall be of such strength to withstand the forces exerted from boring and jacking operation as well as the vertical loading imposed on the pipe after installation. The weld shall also be such that it provides smooth, nonobstructing joint in the interior of the pipe. Backfill and bedding at ends of bore shall be as indicated on the Drawings. Spacers on 5’ centers shall be installed to separate the conduits from the cover pipe. No greater than ½” of movement is acceptable after spacers are installed.

3.11 DEMOLITION

A. For equipment indicated to be demolished, remove all conduit, boxes, wiring, switches, and controls associated with the equipment. Concealed conduit may be abandoned in place. All walls, floors, ceilings, and surfaces must be patched and painted to match surrounding surface after demolition is complete.

END OF SECTION

SECTION 16012
ELECTRICAL SUBMITTAL CHECKLIST

PART 1 - GENERAL

1.01 SUMMARY

A. This Section consolidates electrical submittal requirements found in the Division 16 specification sections into checklist tables. The checklist is intended as an administrative control document and does not replace the detailed requirements of the referenced specification sections.

1.02 SUBMITTAL CHECKLIST TABLES

A. Qualifications and Certifications Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16010 / 16020	Electrical contractor license	With initial electrical submittal		
16710	Low Voltage Installer BICSI Certification	With low voltage cabling submittal		

B. Short Circuit, Coordination, and Arc Flash Studies

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16440	Short Circuit & Coordination Study	Prior to switchgear protective device submittal		
16440	Arc Flash Study	Prior to substantial completion		

C. Product Data/Shop Drawing Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16060	Secondary grounding equipment	Prior to procurement		
16075	Electrical identification products	Prior to procurement		
16120	Conductors, cables, circuits, and cable supports	Prior to procurement		
16130	Raceways and fittings	Prior to procurement		
16131	Boxes and cabinets	Prior to procurement		
16140	Wiring devices	Prior to procurement		
16230	Fixed standby generator system	Prior to procurement		
16280	Surge protective devices	Prior to procurement		

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16440	Motor control centers / motor control equipment	Prior to procurement		
16442	Panelboards	Prior to procurement		
16460	Transformers	Prior to procurement		
16483	Adjustable frequency drives	Prior to procurement		
16500	Lighting fixtures	Prior to procurement		
16710	Building telecommunications cabling system	Prior to procurement / installation		
16741	Security gate video intercommunication system	Prior to procurement		
16745	Video surveillance system	Prior to procurement		
16900	Controls and control panels	Prior to procurement		

D. Test Reports, Inspection Reports, Startup, and Commissioning Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16010 / 16020	Electrical system acceptance demonstration – AHJ Final Approval	Prior to substantial completion		
16060	Grounding electrode system test report	After grounding installation/testing		
16120	Megohm meter test results	After conductor installation/testing		
16220	Motor factory certified test reports	With motor submittal or motor delivery		
16230	Generator factory test report	With generator submittal / shipment		
16230	Generator startup report	After startup/commissioning		
16483	AFD factory test reports	With submittal / shipment		
16710	Telecommunications factory reel test reports	With cabling submittal / shipment		
16710	Telecommunications field test report binder	After cable testing		
16741	Gate intercom system test reports	After testing		
16745	VSS performance verification and endurance test report	After performance verification / endurance test		

E. Training Documentation Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16230	Generator Training	After commissioning		
16483	AFD Training	After commissioning		
16741	Gate intercom training	After commissioning		
16745	VSS training	After commissioning		

F. O&M Manuals, Record Drawings, & Closeout Documentation

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16010 / 16020	Red-lined Record Drawings	At substantial completion		
16010/ 16020	Electrical O&M Manuals for general elec. Equipment	At substantial completion		
16230/ 16232	Generator & ATS O&M manuals	At substantial completion		
16280	SPD O&M manuals	At substantial completion		
16440	MCC O&M manuals	At substantial completion		
16483	AFD O&M manuals	At substantial completion		
16741	Security gate video intercom O&M manual	At substantial completion		
16745	VSS O&M manual	At substantial completion		
16900	Control panel O&M manuals	At substantial completion		

G. Spare Parts Delivery Documentation

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16010	AHJ Inspection/Approval	At substantial completion		
16010/ 16020	Misc. Spare Parts	At substantial completion		
16230	Generator Spare Parts	At substantial completion		
16483	AFD Spare Parts	At substantial completion		

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
16741	Security Gate Spare Parts	At substantial completion		
16900	Control Panel As-Built Wiring diagrams for panels	At substantial completion		

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 16014

POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide fault current study, coordination study, and arc flash hazard study for the power system on this project. The study shall include all portions of the 480V distribution system, the 480-240/208V transformers, and the 208/240V panelboards.

B. Provide arc flash labels for the electrical equipment as specified herein.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The latest version available shall be the version referenced unless noted otherwise.

1. IEEE 1584: Guide for Performing Arc-Flash Hazard Calculations
2. IEEE 3002.2: Recommended Practice for Conducting Load-Flow Studies and Analysis of Industrial and Commercial Power Systems
3. IEEE 3002.3: Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems
4. IEEE C2: National Electrical Safety Code
5. NFPA 70E: Standard for Electrical Safety in the Workplace

1.03 SUBMITTALS

A. Submit the following:

1. Field Examination Report
2. Arc Flash Label Formats
3. System Analyzer Qualifications & Modeling Software Information
4. Power System Studies including Single Line Diagram
5. Model files
6. Commissioning Report

1.04 QUALITY ASSURANCE

A. System Analyzer: The System Analyzer must perform the power system studies. The System Analyzer must be a registered professional electrical engineer with a minimum of 3 years of experience with power system studies. Include the license number and state of the registered Professional Engineer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 FIELD EXAMINATION

A. General: Provide a field examination utilizing Qualified Personnel and providing the appropriate PPE, protective barriers, and danger signs for "live" equipment examinations. Gather all the information necessary to perform the required studies. Perform field inspections of the site and equipment before the first study and after the last study to determine the state and settings of the equipment and to verify the final settings agree with the studies. Perform the post-study inspection(s) after changing settings, after performing acceptance tests, and before placing equipment in service. Furnish all materials, labor, and equipment necessary to conduct the examination. Maintain a written record of the all equipment examined, equipment location, equipment ratings, settings, personnel involved, and the date the examination was performed. Submit the written record of each field examination.

B. Application of Arc Flash Labels: Install arc flash warning labels using Qualified Personnel as necessary after the setting and inspection is complete. For new or modified equipment, install labels before the equipment is energized for the first time after installation/modification or setting changes.

3.02 POWER SYSTEM STUDIES

A. Perform power system studies to demonstrate that the equipment selected and system constructed meet the contract requirements for fault current and interrupt ratings, coordination, protection, and Arc Flash Hazard.

B. Submit reports of the studies along with protective device equipment submittals. Apply Arc Flash Hazard labels to equipment after the studies are approved. Update and resubmit the studies after any changes to the equipment or systems which may affect the study results, and re-apply Arc Flash Hazard labels to equipment after the resubmitted studies are approved. The Owner or Engineer is not responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices before approval of the study.

C. Scope of Studies

1. The scope of the studies must begin at the source bus (utility feed) and extend down to system buses where fault current availability is 2,000 amperes or less (symmetrical) and at most 240 volts.

2. In the systems model for the studies, incorporate all existing and new equipment connected to the electrical system. Incorporate any additional sources or load equipment necessary to accurately model the system's performance.

3. Where multiple sources of power may be in service (e.g. – a standby power generator) in various combinations or where electrical loops are in the system, incorporate into the studies all the modes of operation to evaluate the impact of the modes of operation on the system.

D. Determination of Facts

1. Determine and document the time-current characteristics, features,

ratings, ampacities, and nameplate data for each existing protective device, electrical equipment, and feeder cables. Obtain the available fault current from the electrical utility. For multiple modes of operation, use the mode with available fault current that produces the greatest incident energies in the arc flash hazard study.

2. Utilize field-verified data in the power system studies. Document the field-verified data in the report.

E. Single Line Diagram

1. Provide a single line diagram showing the electrical system buses, devices, transformation points, and all sources of load current and fault current, including generator and motor contributions. Provide a diagram from the system model. Each bus, device or transformation point must have a unique identifier. Show the location of switches, breakers, and circuit interrupting devices on the diagram together with available fault data, and the device interrupting rating.

2. The naming of existing components within the system model and single line diagram must match existing installed equipment names. The naming of new components within the system model and single line diagram must use unique identifiers and match the Engineer's Drawings.

F. Fault Current Study: Perform the fault current study in accordance with IEEE 3002.3. Provide balanced three-phase fault, bolted line-to-line fault, and single line-to-ground fault current values at each voltage transformation point and at each power distribution bus. For each location, show in tabular form on the diagram or in the report the maximum and minimum available fault currents of all modes of operation for that location. Where the available fault current at the source bus is not available, describe how the fault contribution from the source bus was determined and why this method is reasonable for the study.

G. System Coordination Study: Use the results of the fault current study. For normal modes of operation, demonstrate that selectivity has been obtained between the devices within the scope of the project. Demonstrate the equipment, machines, and conductors are protected from damage from overloads and fault conditions. Include a description of the coordination of the protective devices in this project. Provide a written narrative describing which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations; coordination between upstream and downstream devices; and relay settings. Provide recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost damages (addition or reduction). Provide composite coordination plots on a log-log scale. Where recommendations are provided to improve or enhance system reliability, provide separate coordination plots on log-log scale showing the system coordination before and after the implementation of the recommendations. Where coordination has been adjusted to lower arc flash values, include a discussion of the change and the impact on the system within the report.

H. Arc Flash Hazard Study: Perform the arc flash hazard study in accordance with IEEE 1584.1. Utilize the data from the fault current study to determine the worst case incident energy per IEEE 1584, IEEE C2, and OSHA 29 CFR 1910.269 Appendix E. Use identified modes of operation to determine the worst-case arc flash energy. If not included in another study, include a description of the devices and device settings for the operating modes that provided the highest arc flash energy. The use of a "maintenance switch" to temporarily reduce the Arc Flash incident energy for maintenance work is acceptable. Where the adjusting the coordination of devices to obtain lower arc flash values, include a

discussion of the change and the impact on the system within the report. Where the arc flash energies exceed 4 cal/cm2 provide recommendations to reduce the arc flash energy to below this threshold.

I. Where the AC system voltage is 240 volts or less with an available short-circuit current less than 2000 A, an arc flash hazard study is not required.

J. Study report(s)

1. Include a narrative describing the studies performed; the bases and methods used; and the desired method of coordinated protection of the power system.

2. Include descriptive and technical data for existing devices and new protective devices proposed. Include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices. For existing devices, included statements on the condition of the equipment based upon field inspections and owner's statements and reports.

3. Document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristic curves, current transformer ratios, and relay device numbers and settings; generator resistance and reactance values, and time constants; and existing power system data including time-current characteristic curves and protective device ratings and settings. Identify all assumptions about the protection devices, equipment, and system where data was not available.

4. For each bus in the system, provide fully coordinated composite time-current characteristics (TCC) curves as required to ensure coordinated power system protection between protective devices and equipment. In a tabular format, provide recommended ratings and settings of all protective devices.

5. Provide the calculations performed for the studies, including computer programs utilized. Provide the name of the software package, developer, and version number.

6. The System Analyzer must stamp the study reports.

3.03 Arc Flash Labels

A. Provide arc flash warning labels for the electrical equipment. Typical types of equipment include transformers, switchgear, switchboards, panelboards, disconnect switches, industrial control panels, meter socket enclosures, and motor control centers. The arc flash label naming must match the naming used in the system modeling and the single line diagram.

B. Comply with the label requirements specified in NFPA 70E. Obtain approval of arc flash label formats before printing.

1. Provide a 4 inch x 6 inch thermal transfer type label of high adhesion polyester for each location device analyzed. The label must remain in place and be legible for at least 10 years in the installed environment.

2. Labels must be machine printed with no field markings. Provide arc flash labels in the following manner. All labels must be based on implemented overcurrent devices and settings.

3. Where the equipment construction has different hazards levels in different

areas, provide a label for each compartment, cubicle, or section separated by barriers

4. Use the worst-case hazard of all operating scenarios unless mitigation procedures are used. If mitigation procedures are used, explain the procedures on the label.

5. The incident energy in cal/cm2 must be on the arc flash label. In addition, specific PPE requirements must be listed on the label. This is different from listing the PPE Category, which should not be done. The specific PPE requirements shall list the various articles of PPE required (e.g. gloves, arc suit, ear plugs, etc.)

3.04 MODELING

A. Develop a software model of the electrical system identified in the scope of the studies. The acceptable software models are SKM, ETAP, or EasyPower. Develop the model with accurate, verified information. Model existing electrical equipment, machines, devices, and conductors directly connected to, altered by, or otherwise affected by the work. This includes, but is not limited to generators, transformers, switchgear, switchboards, panelboards, motor control centers, motors, voltage regulators, tap changers, protective relays, circuit breakers, switches, fuses, conductors, capacitors, reactors, grounding system, and control equipment.

B. Provide the final model files in their native editable formats for future use by the Owner/Engineer. Include device information for devices not in the software vendor's standard distribution.

3.05 COMMISSIONING REPORT

A. Provide a report documenting that approved study coordination and trip settings were implemented and that arc flash labels were applied. Note any deficiencies in the report.

-- End of Section --

SECTION 16060

SECONDARY GROUNDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Grounding shall be provided in accordance with the NEC, as described in these Specifications, and as shown on the Contract Documents.

1.02 RELATED DOCUMENTS

A. Section 16010 – General Electrical Requirements

1.03 SUBMITTALS

A. Submittals are required on all grounding equipment in accordance with Section 16010.

1.04 QUALITY ASSURANCE

A. Codes and Standards

1. NEC Compliance: Grounding must conform to NEC requirements.

2. UL Compliance: Comply with applicable requirements of UL Standard No. 467 "Electrical Grounding and Bonding Equipment" and No. 869, "Electrical Service Equipment." All grounding and bonding products shall be UL listed and labeled for their intended usage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Grounding equipment shall be Cadweld, Thomas and Betts/Blackburn, Erico, Copperweld Bimetallics Group, Cathodic Engineering Equipment Co., or equal.

2.02 GROUND RODS

A. Ground rods shall be copper-clad steel with minimum diameter of ¾" and length of 10'. They shall confirm to UL467 requirements.

2.03 GROUND CONDUCTORS

A. Conductors shall be copper and sized as indicated on the Drawings. If size is not indicated than the conductors shall be sized according to the NEC.

2.04 GROUNDING ACCESSORIES

A. Provide all grounding accessories necessary for a complete, functional, code-compliant grounding system. This includes but is not limited to the following: connectors, lug terminals,

electrodes, bonding jumpers, surge arresters, tape, heat-shrink tubing, exothermic welding materials, bonding straps, etc.

2.05 GROUND ENHANCEMENT MATERIAL

A. Ground enhancement material shall be GEM by Erico Products, Powerfill by Cathodic Engineering Equipment Company, or equal.

B. The ground enhancement material must be permanent and maintenance free (no recharging with salts or chemicals which may be corrosive) and maintain its earth resistance for the life of the system. It must set up firmly and not dissolve or decompose, or otherwise pollute the soil or local water table. The material shall be capable of being applied dry or in a slurry form, and shall reduce resistance by at least 40 percent.

C. Basic components of this material shall be carbon, hydraulic cements, and hydrous aluminum silicates. Minimum 4-inch diameter holes shall be used with ground rod installations, with depth 6" shorter than length of rod, completely filled with the material. Trenches for grounding electrode conductor shall also utilize this material the full length from electrode to building, in accordance with manufacturer installation recommendations, except trench depth shall allow buried conductor to be at least 2'-6" deep.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Grounding shall utilize a supplemental driven ground rod system in a bed to achieve the design ground resistance.

B. The ground system shall be continuous with all structures on a common ground. This can be accomplished by bonding all conduits together and bonding to the ground bus at each motor control center. Bonding jumpers shall be required at all pull boxes, and at all motor casings. A separate grounding conductor shall be pulled in all conduits in addition to wire counts shown on Drawings.

C. Where multiple rods are driven, they shall be separated by at least 10 feet to assure maximum effect.

D. Ground resistance between ground and absolute earth shall not exceed 5 ohms.

E. All grounding and grounding electrode systems shall be as required by the NEC as for types of electrodes utilized and sizing of grounding conductor to service equipment from the electrode system. These shall include footer rebar, buried metal water pipe, buried bare copper conductor, etc.

F. All grounding electrode system connections shall be made using exothermic welds, Cadweld, or equal. No splices are allowed in the grounding electrode conductor.

G. Where indicated, an insulated, isolated ground shall be run from the service entrance to panels serving computers.

H. Should ground rods be impractical for use due to rocky conditions, then grounding electrode plates may be used after acceptance by the Engineer on a case by case basis.

3.02 FIELD QUALITY CONTROL

A. Testing

1. The Contractor shall provide all labor, tools, instruments, and materials as necessary to perform testing of the grounding electrode system. Results shall be submitted in writing to the Engineer. The testing shall be done to determine the effectiveness of the selected grounding scheme and to see that it conforms with resistance specified (5 ohms maximum).

2. The testing should be done using a fall-of-potential method test at the point of grounding electrode conductor connection to main power distribution equipment and at each separately derived system or MCC. The test shall be performed no sooner than 48 hours after a rainfall event.

3. The written report should contain the following information:

   a. Type of ground scheme used, i.e., building steel, driven rod, mat, etc.

   b. Type of instrument used.

      (1) Manufacturer
      (2) Model Number
      (3) Confirm fall-of-potential test
      (4) *Serial Number
      (5) *Where instrument was obtained

      *These 2 items are required so that the same instrument may be utilized should reproduction of the test be necessary due to unsatisfactory readings/instrument miscalibration.

   c. Ground resistance readings obtained at various test distances.

   d. Ground resistance/distance curve.

   e. Value of Grounding Electrode Resistance at knee of curve.

   f. Sketch showing setup of instrumentation and location of grounding electrode and test probes.

   g. Proposed method to achieve the specified resistance, should an unacceptable reading be obtained.

   h. Ground resistance readings obtained (if applicable) after modifications incorporated.

3.03 GROUND ENHANCEMENT MATERIAL

A. Where indicated on the Drawings or as deemed necessary by the Contractor to achieve design grounding electrode system resistance, a ground enhancement material shall be utilized, in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 16070
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. All electric equipment shall be rigidly mounted and installed using supporting devices as indicated on the Contract Drawings, as required by the work, and as described herein.

1.02 RELATED WORK

A. Section 16010 – General Electrical Requirements

1.03 SUBMITTALS

A. Submittals are required in accordance with Section 16010 requirements.

1.04 QUALITY ASSURANCE

A. Electrical components shall be listed and labeled by UL, ETL, CSA, or similar.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Strut: “Kindorf,” “Unistrut,” “B-Line,” “Allied Tube & Conduit,” or equal.

2.02 STRUT

A. Epoxy-Painted: ASTM A1011 (Fittings – ASTM A1018) 33,000 psi minimum yield, coated with water-borne epoxy deposited via cathodic electro-deposition. Accessory hardware shall be ASTM B633 zinc-plated.

B. Galvanized: Either pre-galvanized, ASTM A653 with G90 coating, or hot-dip galvanized per ASTM A123. Accessory hardware shall be ASTM B633 zinc-plated.

C. Aluminum: Extruded alloy 6063-T6. Accessory hardware shall be stainless steel type 18-8 or 304.

D. Stainless Steel: AISI Type 304 or 316. Accessory hardware shall be stainless steel type 18-8, 304, or 316.

E. Fiberglass resin strut shall be used in chemical areas. Hardware shall be 316 stainless steel.

2.03 HARDWARE

A. All hardware for interior electrical room shall be zinc-plated.

B. All hardware for process rooms and exterior areas shall be 316 Stainless Steel.

PART 3 - EXECUTION

3.01 ANCHORING CABINETRY

A. All free standing equipment shall be anchored to its foundation using expansion bolts of the size and number recommended by the equipment manufacturer.

B. Wall-mounted cabinets, safety switches, panels, and other devices shall be mounted with an air gap of minimum 0.5 inch between the wall and the cabinet.

3.02 ANCHOR METHODS

A. Concrete: Expansion anchors, preset inserts, or purpose made anchors.

B. Hollow Masonry: Toggle bolts or expansion anchors.

C. Wood Surfaces: Wood screws (#10 min) or lag bolts.

D. Metal Surfaces: Machine screws or bolts.

3.03 STRUT INSTALLATION

A. Table of Acceptable Usage:

AREA	STRUT MATERIALS
Electrical Rooms	Epoxy-Painted, Galvanized, Aluminum
Exterior	Aluminum, Stainless
Miox Generation/Storage Rooms	Fiberglass Resin
All Other Process Rooms	Aluminum, Stainless

B. The only exception to the above shall be anchor bolts for area lightpoles which shall be allowed to have galvanized threads and galvanized nuts.

C. Epoxy-painted strut, where cut in the field, must have ends filed smooth and painted the same color as the strut.

D. Galvanized strut, where cut in the field, must have ends filed smooth and cold galvanized.

E. All field-cut strut shall have ends filed smooth and free of burrs or sharp edges. Any strut installed within 7 feet above finished floor must have protective foam edging applied to prevent injury to personnel.

3.04 SEISMIC CONSIDERATIONS

A. Where indicated or specified, seismic restraints shall be provided for electrical equipment.

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide electrical identification of equipment, boxes, and conductors as specified herein.

1.02 RELATED WORK

A. Section 16010 – General Electrical Requirements

1.03 SUBMITTALS

A. Submittals are required for electrical identification products in accordance with Section 16010 requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Brady, Safety Sign Company, Seton or equal.

2.02 ELECTRICAL IDENTIFICATION PRODUCTS

A. Engraved, Plastic Laminated Labels and Signs: Shall be engraved stock melamine plastic laminate, 1/16 inch minimum thickness, and shall have white plate with black letters.

B. Vinyl self-adhesive signs: Shall warn of "High Voltage" (state the specific voltage). The type of labels to be used shall have orange as the basic color to conform with OSHA requirements, and letters shall be black. The labels shall be of proper size to fit flatly on the surface of the enclosure to make for a neat appearance and not interfere with the operating function of the device it is attached to.

C. Colored Adhesive Marking Tape for Wires and Cables: Self-adhesive, vinyl tape not less than 3 mils thich by 1 inch in width.

D. Conductor Labels: Shall be machine printed, heat-shrink type.

E. Underground line marking tape: Permanent, red-colored, continuous printed, not less than 6 inches wide and 4 mils thick. Tape shall have metal-backing suitable for tracing.

PART 3 - EXECUTION

3.01 EQUIPMENT LABELING

A. All starters, feeder units in panelboards, disconnects, instruments, etc. shall be marked to indicate the motor, outlet, or circuit they control. Marking is to be done with engraved laminated nameplates

and shall bear the designation shown on the Contract Drawings where this information is given. Nameplates shall be fastened to equipment with stainless steel screws, minimum of one each side. In no way shall the installation of mounting screws void the NEMA enclosure rating of the equipment in which they are installed. Nameplate background color shall be white, with black engraved letters, unless otherwise noted. Typical panelboard label:

"Panel PP1
225A 480Y/277 3PH 4W
Fed From Panel MCP"

Typical Safety Switch Label:

"AHU-5
480V 3PH
Fed From Panel PP1"

Typical Instrument label:

"PIT-501
High Service Discharge Pressure"

B . All cabinets, disconnect switches, control panels, transfer switches, panelboards etc. shall be additionally labeled with orange OSHA-compliant vinyl self-adhesive signs that list the maximum voltage contained inside the cabinet or panel.

C. Branch circuits in lighting panels shall be typed on a card suitable for the card frame furnished with the panel. The card shall bear the panel designation listed on the Contract Drawings where this information is given, as well as indicate what each circuit controls. The Contractor shall retype new cards for all existing panelboards modified.

D. Submersible pumps shall be furnished with a spare nameplate which shall be installed inside the MCC or starter enclosure.

E. All mechanical equipment on the project that has electrical service shall be labeled and the equipment labels must match the breaker labels. Coordinate with Divisions 2, 11, and 15.

3.02 BOX LABELING

A. Label each box with the voltage and circuit numbers contained.

3.03 CONDUCTOR LABELING

A. Label each conductor to match the circuit number or manufacturer's shop drawing wiring diagrams.

3.04 ARC-FLASH HAZARD LABELING

A. Electrical equipment shall be labeled with Arc-Flash hazard warning labels as required by the N.E.C. Labeling shall comply with ANSI Z535.4.

END OF SECTION

SECTION 16120
CONDUCTORS, CABLES, AND CIRCUITS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide conductors, cables, and circuiting as indicated and as specified herein for a complete, functional electrical system.

1.02 RELATED WORK

A. Section 16010 – Basic Electrical Requirements

B. Section 16075 – Electrical Identification

C. Division 17 – Instrumentation/SCADA

1.03 SUBMITTALS

A. Submittals are required on all cables and conductors in accordance with Section 16010 requirements.

B. Submittals are required on cable supports.

C. Submit test results as specified herein.

1.04 QUALITY ASSURANCE

A. All wire and cable shall conform to the latest requirements of the NEC and shall meet all ASTM/UL specifications. Wire and cable shall be new; shall have size, grade of insulation, voltage rating and manufacturer's name permanently marked on the outer covering at regular intervals. Complete descriptive literature shall be submitted to the Engineer for review and acceptance prior to installation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Wire and cable shall be suitably protected from weather and damage during storage and handling and shall be in first class condition when installed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Building Wire (type "THWN-2" or "XHHW-2") - "Collyer," "Rome," "American," "Carol," or equal.

B. Flexible Cords and Cables (Types "SO" (600V) "SJO" - 300V) "Collyer," "American," "Carol," or equal.

C. Control Cables (Shielded or unshielded) 600V max. - "Belden," "Eaton-Dekoron," "Okonite," or equal.

D. Instrumentation Cables (Shielded) 600V mx. - "Eaton-Dekoron," "Manhatton," "American," "Belden," "Okonite," or equal.

E. Cable Supports – Hubbell/Bryant or equal.

2.02 GENERAL

A. In general, all conductors shall be 98 percent conductive, annealed copper unless otherwise noted on the Contract Drawings.

B. Conductors with high temperature rated insulations and special construction shall be used where required in connecting to light fixtures or appliances that have special requirements.

C. Telecommunications and data cabling shall be as specified in applicable sections.

D. Cables shall be plenum-rated where installed in environmental air plenums or otherwise where required by the NEC.

2.03 GENERAL BUILDING WIRE

A. Conductors for non-AFD (adjustable frequency drive) applications shall be type THWN-2 insulation and shall be UL 44 listed. Conductor size shall be AWG (American Wire Gauge) Standard. Minimum conductor size shall be AWG number 12 except branch circuits in excess of 75 feet from panel to first outlet not smaller than no. 10 AWG. Minimum voltage rating shall be 600 volts. Conductors for small power may be solid (i.e. lighting, receptacles), but conductors for control work shall be stranded.

B. Conductors for AFD applications shall be type XHHW-2 insulation and shall be UL 44 listed. Conductor size shall be AWG (American Wire Gauge) Standard. Minimum conductor size shall be AWG number 12. Minimum voltage rating shall be 600 volts. Conductors shall be stranded.

C. Conductors inside control panels, that do not extend outside the cabinet, shall be Type MTW with a minimum size of 18 gauge and a minimum voltage rating of 600V. Each conductor shall be terminated with a ferrule and a wire label.

2.04 INSTRUMENTATION CABLE

A. Instrumentation cable shall have individually shielded and twisted pairs or triads. Conductors shall be tinned copper, and the cable shall include a separate drain conductor. Voltage rating shall be 300 Volt where cable extends into a 240VAC (or lower) cabinet. Rating shall be 600 Volt where cable extends into a 480VAC (or lower) cabinet. Conductor colors shall be black and white or red and black. Shielding shall be a combination braid/foil with 100% coverage. Jacket shall be PVC or XLPE with a thickness of at least 0.045" thick. Conductors shall be #18AWG minimum, but no smaller than the size indicated on the Drawings.

B. All signal lines should be constructed of individually twisted pairs (6 to 10 twists per foot), including thermocouple extension leads. Cables should be made of twisted pairs, with all lays and pairs twisted in the same direction for maximum flexibility.

C. Insulation resistance at 68 degrees Fahrenheit between conductors and between conductors and ground should be at least 500 megohms per 1,000 feet.

D. Cables to be installed outside, underground in conduits/ducts, or in other wet locations shall be listed for wet location use.

2.05 MULTICONDUCTOR CONTROL CABLE

A. Shall be concentrically cabled No. 14 AWG stranded copper conductors with saturated interstitial fillers; overall binder of nylon or similar material; and PVC jacket. Quantity of conductors shall be as

indicated on the Drawings, with 25% spare minimum. Conductor insulation shall be 20 mils of polyethylene with 10 mils PVC, rated 600V.

B. Color coding shall be ICEA, Method 1.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. General

1. For power branch circuits, conductors shall be continuous from overcurrent protection terminals to load/safety switch terminals. No splices will be permitted for power branch circuits without the specific authorization of the Engineer. For receptacle/lighting circuits, conductors shall be continuous from outlet to outlet and no splices shall be made except accessible in junction or outlet boxes. Wire connectors of insulating material or solderless pressure connectors, properly taped, shall be used for all splices in wiring, wherever possible.

2. Feeder conductors shall be color coded in accordance with the following schedule:

	480/227V 3 Phase	208/240V 3 Phase	120/240, Single Phase
Phase A	Brown	Black	Black
Phase B	Orange	Red	Red
Phase C	Yellow	Blue	
Neutral (Grounded)	White or Light Gray	White or Light Gray	White or Light Gray
3-Way Tracers			Blue
Grounding	Green	Green	Green
Remote Energized Control Conductors			Yellow
Standard Control			Red

3. Conductors shall be pulled into raceways in strict accordance with manufacturer's recommendations.

4. Ample slack conductors shall be allowed at each terminal point, and pull or junction box, to permit installation with ease and without crowding.

5. All conductors terminating at terminal blocks shall be identified with numbers and/or letters identical to circuit or control identification.

6. No conductors shall be drawn into conduits until all work which may cause wire or cable damage is completed. Wire pulling shall be accomplished utilizing machinery and accessories intended for the purpose.

7. All connections and splices shall be made in accordance with conductor manufacturer's recommendations, and as written herein.

8. If the size and number of conductors in a conduit on the Drawings is not shown, then it shall be assumed to be 4#12, 3/4" C.

9. An equipment grounding conductor, sized per NEC, shall be installed in each power, signaling, or instrumentation circuit whether indicated or not.

10. Wiring size shall not be smaller than indicated on the Drawings. If the size is not indicated, Contractor shall size wiring based on a 75°C temperature rating along with appropriate derating for temperature, number of conductors in a conduit, and other factors as required by the NEC.

B. Feeders

1. Wire (up to and including #6 AWG) shall be factory color coded for each phase and neutral, with green used for the ground conductor. Larger conductors shall be identified with tape per Section 16075 requirements. As far as practical, all feeders shall be continuous from origin to panel termination without running splices in intermediate pull boxes. Any splices must be specifically authorized by the Engineer.

C. Instrument Cable

1. Instrumentation cable must only be installed in dedicated conduits with other instrumentation cable. Installation with power conductors is prohibited.

2. All shields must be grounded at one point only as close as possible to the signal source.

3. A minimum separation of 12 inches between analog signal leads and AC power leads should be maintained. For AC power leads carrying 100 amps or greater, a 24 inch separation should be maintained. Parallel runs should be limited to less than 500 feet. Perpendicular runs may be as close as 6 inches.

3.02 FIELD TESTING

A. Megohm meter testing is required on circuits with #4 and larger conductors. Prior to energizing, check with 1000V megohm meter to determine insulation resistance levels to assure requirements are fulfilled. Minimum acceptable reading is 100 megohms held at a constant value for 15 seconds. A certified copy of megohm meter tests shall be submitted to the Engineer and included in the O&M manuals. Test results shall include ambient temperature and humidity at time of testing.

END OF SECTION

SECTION 16130

RACEWAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section of includes all raceways for accommodation of electrical conductors, communications conductors, sleeves for underground electrical installations, conduit stubs for future installations, fittings and accessories.

B. All raceways and fittings shall be painted to match existing or surrounding surfaces except in mechanical spaces.

1.02 RELATED WORK

A. Section 16010 – General Electrical Requirements

B. Division 9 – Paint

1.03 SUBMITTALS

A. Submit are required on all raceways and fittings in accordance with Section 16010 requirements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tubular Raceways

1. Steel, Galvanized, Electric-Metallic-Tubing (EMT) - “VAW,” “Triangle,” “Allied Tube & Conduit Corp,” or equal.

2. Steel, Intermediate Metal Conduit (IMC, Electro-Galvanized, Rigid, Threaded - “Allied Tube and Conduit Corp.,” “Triangle,” “Wheatland Tube Co.,” or equal.

3. Plastic (PVC); Type 80 (or Schedule 80) (Heavy -Wall) - “Robin-Tech,” “Carlon,” or equal.

4. Aluminum, Rigid, Heavy-Wall, Threaded - “VAW,” “Alcoa,” “Reynolds,” or equal.

5. Steel, Galvanized, Rigid, Heavy-Wall, Threaded - “Wheatland Tube Co.,” “Triangle,” “Allied Tube & Conduit Corp.,” or equal.

6. Flexible Metal Conduit - “AFC,” “Alflex,” or equal.

7. Liquidtight Flexible Metal Conduit - “Carol Cable Co., Inc.,” “Superflex,” “OZ Gedney,” or equal.

B. Wireways

1. “Square-D,” “Hoffman,” or equal.

C. Raceway Fittings

1. Conduit fittings - “Crouse-Hinds,” “Appleton,” “OZ Gedney,” or equal.

2. Non-metallic conduit fittings - “Robin-Tech,” “Carlon,” “Scepter,” or equal.

3. Flexible conduit fittings - “Raco,” “T & B,” “OZ Gedney,” or equal.

D. All raceways shall be marked with the manufacturer’s name or trademark as well as type of raceway and size. This marking shall appear at least once every 10 feet and shall be of sufficient durability to withstand the environment involved. All raceways shall be furnished and installed as outlines under Part 3 of this Specification.

2.02 MATERIALS

A. Aluminum Conduit

1. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type, non-toxic, corrosion resistant, and non-staining. It shall be manufactured per UL standards as well as listed/labeled by same.

2. Fittings, boxes, and accessories used in conjunction with aluminum conduit shall be die cast, copper free type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.

3. Aluminum conduit proposed for concrete slab or underground applications shall be UL listed for the purpose and factory pre-coated. Corrosion-resistant taping is allowed for stubouts out of the ground.

B. Rigid Steel Conduit

1. Rigid steel conduit and fittings shall be of mild steel piping, galvanized inside and out, and shall conform to UL standards. The conduit and fittings hall be listed and labeled by UL as well. The galvanized coating of zinc shall be of uniform thickness applied by the hot-dipped process, and shall be applied also to the threads. It shall be further dipped in a chromic acid bath so as to chemically form a corrosion resistant protective coating of zinc chromate which has a characteristic yellow-green color. Each piece of conduit shall be straight, free from blisters and other defects, cut square, and taper reamed. It shall be delivered with plastic protectors on the threads.

C. Polyvinychloride (PVC) Conduit

1. PVC conduit and fittings shall be Schedule 80 heavy wall, as indicated in these Specifications manufactured to conform to UL standards. It shall be listed and labeled by UL. It shall have at least the same temperature rating as the conductor insulation. Expansion joints shall be used as recommended by the manufacturer in published literature. PVC systems shall be 90 degrees Celsius minimum UL rated, have a tensile strength of 7,000 psi @ 73.4 degrees Fahrenheit, flexural strength of 11,000 psi and compressive strength of 8,000 psi.

2. PVC conduit support clamps shall be non-metallic, non-corroding and specially designed for expansion and contraction. Adapters shall be provided for use with strut. Provide IPEX Scepter or equal.

D. Electrical Metallic Tubing (EMT)

1. EMT shall be high grade steel with an exterior galvanized coating of zinc applied uniformly by the electro-galvanized process. The interior surface shall be uniformly coated with aluminum lacquer or enamel. After galvanizing, it shall be dipped in a chromic acid bath to chemically form a protective coating of zinc chromate. The conduit shall conform to UL standards and be listed as well as labeled by UL.

E. Intermediate Metal Conduit

1. Intermediate metal conduit (IMC) shall be made of high performance steel and given extra strength by a special electro-weld forming process, and shall have a larger internal diameter than rigid steel conduit. IMC conduit shall be listed and labeled by UL. Exterior surfaces shall be hot-dip galvanized in the smaller sizes and electro-galvanized in the larger sizes and then chromated. All threads shall be galvanized after cutting. The interior wall shall be coated with a silicone epoxy-ester lubricant. Each piece of conduit shall be straight, free from blisters and other defects, cut square, and taper reamed.

F. Flexible Conduit

1. Flexible metallic conduit shall be constructed from flexibly or spirally wound elecro-galvanized steel. Connections shall be by means of galvanized malleable iron squeeze type fittings, or tomic twist-in type in sizes not exceeding 3/4 inch. Liquidtight conduit shall be light gray in color and have sealtight fittings, type UA. It shall be sunlight resistant and suitable for minimum temperature range of -22°F to 140°F. Where aluminum conduit is required below, the liquidtight fittings shall be constructed of copper-free aluminum. Where PVC conduit is required below, the liquid-tight shall be type NMUA non-metallic with non-metallic fittings.

G. Conduit Fittings

1. Rigid Steel and IMC Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows made only of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.

b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

d. Erickson (union-type) couplings: Approved for use in concrete are permitted or use to complete a conduit run where conduit is installed in concrete.

e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, installed fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.

f. Fittings for PVC coated rigid conduit shall be manufactured by the maker of the conduit.

g. Compression fittings are NOT acceptable for use with Rigid conduit. All connections are required to be threaded.

2. Rigid Aluminum Conduit Fittings

a. Standard threaded locknuts and bushings shall be malleable iron, zinc-plated steel or aluminum alloy materials. Bushings/hubs shall have insulated throats. Elbows, couplings, hubs, and connectors shall be aluminum. Aluminum fittings containing more than 0.4 percent copper are prohibited.

b. Set screw or compression fittings: Not permitted for use with aluminum conduit.

3. Electrical Metallic Tubing Fittings

a. Only material of steel or malleable iron is acceptable.

b. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for all conduit sizes.

c. Set screw indent type connectors or couplings are prohibited.

d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

4. Expansion and Deflection Couplings

a. Accommodate 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

b. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL, and the NEC code tables for ground conductors.

c. Watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material and stainless steel jacket clamps.

H. Corrosion-Protection Tape: The corrosion protection tape shall be Scotchrap 51 or equal with 20mil thickness PVC tape and high-tack adhesive. Degreasing and priming of the conduit is required prior to applying the corrosion-protection tape.

I. Duct Seal: Sealant shall be UL-listed electrical duct seal, Gardner Bender #1003 or equal. Caulk is not acceptable. Sealant shall be asbestos-free, permanently soft/non-hardening, FDA/USDA approved non-toxic, non-corrosive, non-irritant, and paintable. Temperature range shall be -30°F to 175°F, minimum.

PART 3 - EXECUTION

3.01 PREPARATION

A. Underground metallic conduits shall be degreased, primed, and wrapped with all-weather corrosion-resistant tape to 6" above finished grade. The tape shall be 50% overlapped such that there is an effective 2-layers of tape protecting the conduit.

3.02 INSTALLATION

A. Conduit

1. Conduit shall not be installed in wall cavities between face brick and block. The only time this will be allowed is for serving an exterior receptacle or light fixture.

2. Underground raceways (conduit) shall be provided with steel sleeves where they pass over or under obstructions, such as: sidewalks; roadways; piping; etc.

3. All conduit shall have an insulated ground wire pulled to all equipment and receptacles.

4. All raceway runs are shown diagrammatically to outline the general routing of the raceway. The installation shall be made to avoid interference with pipes, ducts, structural members or other equipment. Should structural or other interference prevent the installation of the raceways, or setting of boxes, cabinets, or the electrical equipment, as indicated in the Drawings, deviations must be approved by the Engineer, and after approval, shall be made without additional charges and shown on the Record Drawings.

5. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases, with UL listed sealants only. Completely fill and seal clearances between raceways and openings with the fire stop material.

6. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

7. No conduit shall be run exposed across roofs or floors without first obtaining permission from the Engineer.

8. Conduits shall not be run inside concrete slabs. Install underneath the slab as detailed on the Drawings.

9. No conduit shall be run exposed across floors.

10. Electrical conduits and/or equipment shall be rigidly supported. Anchors used shall be metallic expansion type, or if appropriate to prevent spalling concrete, epoxy set type.

11. Contractor shall provide all necessary supports in accordance with KBC Seismic requirements.

12. All conduit shall be installed in a first class workmanship manner. It shall be installed in horizontal and vertical runs in such a manner as to ensure against trouble from the collection of trapped condensation and shall be arranged so as to be devoid of traps wherever possible. Special care shall be used in assuring that exposed conduit runs are parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. No open wiring is allowed.

13. Fittings or symmetrical bends shall be required wherever right angle turns are made in exposed work. Bends and offsets shall be avoided wherever possible, but where necessary, they shall be made with an approved conduit bending machine. All conduit joints shall be cut square, reamed smooth and drawn up tight, using couplings intended for the purpose.

14. Conduits shall be securely fastened to all NEMA 1 sheet metal outlets, junction and pull boxes with double galvanized locknuts and insulating-grounding bushings. Conduits entering into NEMA 12/3R/4/4X boxes or where located in NEMA 12/3R/4/4X areas

shall utilize Myers sealing hubs. Sealing locknuts will only be allowed for PVC. Conduit crossings in insulating roof fill will require both conduits to be secured to the roof deck, and these crossings can only be made where the insulating fill is a minimum of 3 inches deep. Runs of exposed conduit shall be supported in accordance with the NEC using cast aluminum or malleable iron one hole pipe straps with spacers to provide an air space behind the conduit. Stainless steel minerallaac, one piece conduit clamps shall be acceptable where located such that building occupants are not in danger of inadvertent contact, since this type fitting has several sharp edges. In general terms, they may be considered in areas such as on or above ceilings, or high on walls. All conduit in walls and slabs shall be securely braced, capped (wooden plugs are prohibited), and fastened to the forms to prevent dislodgement during vibration and pouring of concrete.

15. During construction, all conduit work shall be protected to prevent lodgement of dirt, plaster or trash in conduits, fittings or boxes. Conduits which have been plugged shall be entirely freed of accumulations or be replaced. All conduits in floors or below grade shall be swabbed free of debris and moisture before wires are pulled. Crushed or deformed conduit shall not be permitted.

16. All open conduit work through floor slabs shall be made watertight by grouting around conduit. Provide coating where conduit comes in contact with all concrete.

17. Where metallic conduit penetrates a floor slab the conduit shall be corrosion-taped to a point 6 inches above the penetration.

18. The final section of conduit connecting each motor or piece of utilization equipment subject to vibration shall be of the flexible type. Type “UA” shall be used in all process areas and in outdoor or wet locations. Flexible conduit to space heaters shall be long enough to allow swivel action.

19. All underground conduits entering a building shall be sealed against water/condensate entering around the conductors with duct seal.

20. In certain situations, conduit expansion joints shall be required to ensure against conduit and/or cable damage due to settling or thermal expansion and contraction. These expansion joints shall be required where required by the manufacturer or the Contract Drawings and shall be installed per manufacturer’s instructions.

21. All conduit work in the finished space of each new structure shall be concealed except for conduits to lighting fixtures in buildings with precast roof slabs, or excepted as noted on the Contract Drawings. Conduits entering from underground into buildings shall be watertight through the wall, both inside and outside.

22. Where PVC conduit is installed, underground transition shall be made to metallic conduit at bends where wire pulling could cut conduit.

23. Aluminum conduit shall not be used underground or placed in concrete slabs, unless it is UL listed for the purpose and factory pre-coated.

24. Conduit stubs, for future use, extended through outside walls shall be capped with threaded pipe caps and coated to prevent corrosion. Stubs shall extend 5 feet beyond the walls from which they are stubbed unless otherwise indicated on the Contract Drawings.

25. All metal raceway systems shall be grounding conductive, solidly bonded throughout and grounded in accordance with NEC requirements and/or as noted on the Contract Drawings. In addition, all raceway systems shall be provided with separate grounding conductors.

26. Minimum conduit size shall be 3/4 inch.

27. The following shows the minimum burial depth required for all exterior conduit or cable:

Rigid Metal Conduit	30"
Schedule 80 PVC	30"

28. Wire pulling shall be facilitated by the use of a UL approved pulling compound in pulls over 30 feet in length or where there are 2 or more 90 degree bends. Only polypropylene, nylon, or manila pulling ropes will be permitted. Standard industry recognized wire pulling equipment shall be used.

29. All conduits entering and leaving exterior enclosures shall be sealed around the wires with duct seal. All underground conduits or exterior conduits shall be sealed with duct seal where they penetrate into an interior enclosure.

30. All conduits for emergency lighting systems shall be separate from other building power conduits.

31. Areas of use for each type of conduit:

	PVC	EMT	GRS	IMC	Aluminum
Exterior					
Underground	X		X		
Exposed					X
Building - Interior					
Under/In Floor Slab	X		X	X	
Electrical Room Exposed		X	X	X	X
Interior Concealed		X	X	X	X
MIOX Generation & Storage Rooms Interior	X				
All other Process Rooms Interior Exposed					X

END OF SECTION

SECTION 16131

BOXES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Outlet/device boxes, pull boxes, junction boxes, and underground boxes shall be furnished and installed where indicated on the Contract Drawings, and/or as required by the work in accordance with the NEC.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Electrical Requirements: Section 16010

B. Control Panels: Section 16900

1.03 SUBMITTALS

A. Submittals are required on all boxes and cabinets in accordance with Section 16010 requirements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Boxes: "Wiegmann," "Appleton," "Raco," "Crouse-Hinds," "Hoffman," "Robroy Industries," "Cloud Concrete Products," "Carlon," or equal.

B. Floor boxes, fittings, and poke-throughs: "Hubbell," "OZ Gedney," or equal.

C. Cabinets: "Hoffman," "Wiegmann," "Rittal," or equal.

2.02 OUTLET/DEVICE BOXES

A. Exposed Steel Conduit: Provide cast or malleable iron, zinc-electroplated outlet boxes finished with aluminum lacquer or enamel. Provide cast metal covers with neoprene gaskets for NEMA 4 areas and stamped steel covers for NEMA 12 and undesignated areas.

B. Exposed PVC Conduit: Provide PVC boxes and covers.

C. Exposed Aluminum Conduit: Provide copper-free, cast aluminum boxes. Hardware shall be stainless steel.

D. Concealed Conduit: Provide galvanized coated flat-rolled sheet steel outlet wiring boxes of dimensions required by NEC. Boxes shall be flush mounted.

E. Exceptions to the above shall include NEMA 4X areas, where stainless or non-metallic boxes are required, and NEMA 6, 7, or 9 areas in which the boxes shall be listed for use in the applicable environment.

2.03 JUNCTION AND PULL BOXES

A. Exposed Steel Conduit, up to 50 cubic inches: Provide cast or malleable iron, zinc-electroplated outlet boxes finished with aluminum lacquer or enamel. Boxes shall have drilled external, cast mounting extensions, bossed to provide at least 1/8 inch between the back of the box and the mounting surface for drainage. Provide cast covers with neoprene gaskets.

B. Exposed Aluminum Conduit, up to 50 cubic inches: Provide copper-free, cast aluminum boxes. Hardware shall be stainless steel.

C. Exposed Conduit, larger than 50 cubic inches: Provide sheet metal boxes with hinged covers and appropriate gaskets and NEMA rating. Electrical room area may be painted steel. Where aluminum conduit is required, boxes shall be stainless type 316.

D. Exceptions to the above shall include NEMA 6, 7, and 9 areas in which the boxes shall be listed for use in the applicable environment.

E. Pullboxes for cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and in sidewalks and turfed areas shall be of the same material as the box.

PART 3 - EXECUTION

3.01 INSTALLATION, APPLICATION, AND ERECTION

A. General:

1. Boxes shall be installed in the locations shown on the Contract Drawings. The Contractor shall study the general building plans in relation to the space surrounding each outlet so the work fits the other work required by these Specifications. When necessary, the Contractor shall relocate devices so that when fixtures or other fittings are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment.

2. All supports for outlet boxes shall be furnished and installed by the electrical trades.

B. Concealed Work:

1. All outlet boxes shall be 4 inch by 4 inch standard galvanized steel type at least 1-1/2 inches deep. Exceptions shall be noted on the Contract Drawings. Provide 2-inch single plaster ring for single devices in all CMU walls.

2. Standard deep-type outlet boxes, concrete rings with appropriate covers, shall be used in floor slab construction so concealed conduits entering the sides of boxes can clear reinforcing rods.

3. Outlet boxes for concealed telephone and signaling systems shall be the 4-inch square type, unless otherwise noted or required by the telephone company.

4. See details on the Drawings for box requirements.

C. Interior Pull and Junction Boxes:

1. Interior pull and junction boxes are not shown but shall be used as needed.

D. Pullboxes - Exterior Underground:

1. General:

a. Pull boxes for exterior underground work are shown on the Contract Drawings and are the minimum number required. Others may be added at the Contractor's option, but no extra pay shall be allowed. See details on the Contract Drawings.

2. Pullboxes:

a. Pullbox tops shall be flush with sidewalks or curbs or placed 1/2 inch above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be marked "Electrical" "Communications," or "Instrumentation," as applicable, and provided with two lifting eyes and two hold-down bolts. Each box shall have a suitable opening for a ground rod.

E. Openings in Electrical Boxes:

1. All openings in electrical equipment, enclosures, cabinets, outlet and junction boxes shall be by means of welded bosses, standard knockouts, or shall be sawed, drilled, or punched with tools specially made for the purpose. The use of a cutting torch is prohibited. Unused openings shall be plugged in accordance with the NEC.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Wiring devices shall be provided where indicated on the Contract Drawings.

1.02 RELATED WORK

A. Section 16010 – General Electrical Requirements

B. Section 16130 - Boxes

1.03 SUBMITTALS

A. Submittals are required on all wiring devices in accordance with Section 16010.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. "Hubbell," "Bryant," "Eagle," "General Electric," "Wiremold," "P&S," "Leviton," "Daniel Woodhead," or equal.

2.02 EQUIPMENT

A. Wiring Device Colors:

1. Interior Devices: Ivory

2. Exterior Devices: Grey

B. Receptacles

1. General – All receptacles shall be heavy duty specification grade duplex receptacle, Nema 5-20R, 20A, 125V, 3-wire. Provide weatherproof-in-use cover where indicated on the Drawings. Duplex outlet (interior) - "Hubbell" catalog series 5362, or equal.

2. Single outlet – Hubbell series 5361 single receptacle, or equal.

3. Special purpose outlet - Per equipment requirements.

4. Ground fault interrupting receptacles shall be required where shown on the Contract Drawings, and shall be indicated by the abbreviation "GFI" beside the circuit symbol on the Contract Drawings. They shall be rated 20 amps (125 volts) and shall be of the duplex, feed through type, capable of protecting all downstream receptacles on the same circuit. They shall be UL listed and shall comply with UL 943 and interrupt the current between 4-6 milliamps of ground fault leakage. Appropriate plates shall be furnished and installed. The 20 ampere rating shall apply not only to device internals but to the faceplate as well. Receptacle shall be Hubbell GFI 5352, or equal.

C. Plates and Covers

1. Furnish and install plates of the appropriate type and size for all wiring and control devices, signal and telephone outlets.

2. All plates on surface mounted boxes shall be of 302 stainless steel (nonmagnetic) with rounded or beveled edges, except exterior/outdoor areas, then weatherproof-in-use covers shall be installed. All plates on flush mounted boxes shall be 302 stainless steel. All device plate screws shall be stainless steel with countersunk heads. Screwheads shall be colored to match the plates. Plates shall be installed vertically and with an alignment tolerance of 1/16 inch. Device plates shall be of the one-piece type, of suitable shape for the devices to be covered. Plates shall have a smooth finish with no crevices to collect dirt. Oversize plates are not acceptable.

3. Covers for boxes serving equipment where flexible conduit is to be tapped into cover plates shall be sheet metal drilled for conduit. Gaskets shall be required as well as all special adapters for mounting.

4. Weatherproof covers shall be Hubbell WP series, Thomas and Betts 2CKG, or equal. They shall be weatherproof-in-use with cast aluminum construction. Mounting screws shall be stainless. Protection shall be Nema 3R.

D. Wall Switches (Tumbler Type)

1. General – Switches shall be industrial grades, 120/277VAC, 20A Single pole - “Hubbell” cat. series 1221, or equal.

2. Single pole (exterior) - “Hubbell” cat. no. 1222-gray, or equal, and Bryant 7420 or equal plate.

3. 3-way switches (interior) - “Hubbell” cat. no. 1223, or equal.

4. 4-way switches (interior) - “Hubbell” cat. no. 1224, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Wall Switches

1. Wall switches shall be mounted at a height as indicated on the Drawings, unless otherwise noted on the Contract Drawings.

B. Receptacles

1. Outlets shall be located as shown on the Contract Drawings. Where located in special interior finishes, they shall be properly centered. Boxes shall be of the type noted and accepted for the specific installation.

2. Furnish and install receptacle circuits where called for on the Contract Drawings and/or by these Specifications. Circuits shall be installed in conduit from panel to receptacle, with flush mounted boxes except as noted on the Contract Drawings.

3. Receptacles and lighting circuits shall not be combined on the same overcurrent device. For runs over 75 feet or for 30 amp receptacles, minimum wire size shall be AWG No. 10.

4. Receptacles for specific devices shall be rated at the correct voltage and amperage for that unit.

5. The minimum free length of conductor at each box for the connection of a fixture, switch or receptacle shall be 8 inches. All connections shall be made mechanically and electrically secure.

6. Mounting heights shall be as indicated on the Drawings. Utilize medium mounting height for receptacles in locations subject to flooding.

7. Receptacles over workbenches or countertops or at medium or high mountings shall be mounted so that the grounding slot is below the neutral and hot. All other receptacles shall be mounted with the grounding slot above the neutral and hot.

END OF SECTION

SECTION 16150
WIRE CONNECTIONS AND CONNECTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Wire connection and connecting devices shall be as herein specified.

1.02 RELATED WORK

A. Section 16010 – General Electrical Requirements

1.03 SUBMITTALS

A. Submittals are required in accordance with Section 16010.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Connectors, Lugs, etc. - "T & B", "Anderson", "Burndy", or equal.

B. Ties and Servings - "T & B", "Panduit", or equal.

C. Termination and splice connectors - "3M Scotchlok", "Anderson", "T & B", "Burndy", or equal.

2.02 MATERIALS

A. Wire Splicing and Terminations (600 Volts and Below)

1. Electrical Terminal and Splice Connectors (#22 - #4 AWG)

a. Terminals and splice connectors from #22 - #4 AWG shall be compression types with barrels to provide maximum conductor contact and tensile strength. Performance, construction, and materials shall be in conformance with UL standards for wire connectors and rated for 600 volts and 105 degrees Celsius.

b. Connectors shall be manufactured from high conductivity copper and entirely tin plated. Terminal barrels shall be serrated on the inside surface and have a chamfered conductor entry. Terminals shall have funnel entry construction to prevent strand fold-back. All barrels shall be brazed seam or seamless construction.

c. Spade type terminals shall be sized for the appropriate stud and shall be locking type that snap firmly onto studs with a close fit for maximum retention. Spade type terminals shall be insulated with an insulation suitable for maintaining a high dielectric strength when crimped and be made form nylon, PVC, or equal.

2. Electrical Lugs and Connectors (#6 AWG - 1000 Kcmil)

a. Lugs and splice connectors from #6 AWG - 1000 Kcmil shall be compression types with barrels to provide maximum conductor contact and tensile strength. They shall be manufactured from high conductivity copper and entirely tin plated. They shall be crimped with standard industry tooling. The lugs and connectors must have a current

carrying capacity equal to the conductors for which they are rated and must also meet all UL requirements. All lugs above 4/0 AWG shall be 2 hole lugs with NEMA spacing. The lugs shall be rated for operation through 35 KV. The lugs shall be of closed end construction to exclude moisture migration into the cable conductor.

3. Twist-on Wire Connectors (#22 AWG - #10 AWG)

   a. All twist-on wire connectors must have a corrosion resistant spring that is free to expand within a steel jacket. The steel jacket must be insulated with a flexible vinyl jacket capable of withstanding 105 degrees Celsius ambient temperatures and of sufficient length to cover wires that are inadvertently overstripped.

   b. Each connector size must be listed by UL for the intended purpose and color coded to assure that the proper size is used on the wire combinations to be spliced. The connectors must be compatible with all common rubber and thermoplastic wire insulations.

4. Solderless/re-usable lugs shall be used only when furnished with equipment such as control panels, furnished by others, where specification of compression type lugs is beyond the Contractor's control. In the event their use is necessary, the Contractor shall be responsible for assuring that they are manufactured to NEMA standards, with proper number and spacing of holes and set screws.

PART 3 - EXECUTION

3.01 INSTALLATION, APPLICATION, & ERECTION

A. Insulation of Splices and Connections

1. Connections/splices with a smooth even contour shall be insulated with a conformable 7 mil thick vinyl plastic insulating tape which can be applied under all weather conditions and is designed to perform in a continuous temperature environment up to 105 degrees Celsius. The tape shall have excellent resistance to abrasion, moisture, alkalies, acids, corrosion, and varying weather conditions (including sunlight). The tape shall be equal to Scotch 33+ and shall be applied in conformance with manufacturer's recommendations. In addition, it shall be applied in successive half-lapped layers with sufficient tension to reduce its width to 5/8 of its original width. The last inch of the wrap shall not be stretched.

2. Connections/splices with irregular shapes or sharp edges protruding shall be first wrapped with 30 mil rubber tape to smooth the contour of the joint before being insulated with 33+ insulating tape specified in the previous paragraph. The rubber tape shall be high voltage (69 KV) corona-resistant based on self-fusing ethylene propylene rubber and be capable of operation at 130 degrees Celsius under emergency conditions. The tape must be capable of being applied in either the stretched or unstretched condition without any loss in either physical or electrical properties. The tape must not split, crack, slip, or flag when exposed to various environments. The tape must be compatible with all synthetic cable insulations. The tape must have a dissipation factor of less than 5 percent at 130 degrees Celsius, be non-vulcanizing, and have a shelf life of a least 5 years. The rubber tape shall be applied in successive, half-lapped wound layers and shall be highly elongated to eliminate voids. Other manufacturer's recommendations on installation shall be adhered to. The rubber tape shall be equal to Scotch 23 or 130C electrical splicing tape.

3. Splices made in wet or damp locations shall be made submersible and watertight with special kits made for the application and compatible with type of cables employed.

B. Connection Make-up

1. Connections of lugs to bus bars, etc., shall be made up with corrosion resistant steel bolts having non-magnetic properties with matching nuts, and shall utilize a Belleville spring washer (stainless steel) to maintain connection integrity. Connections shall be torqued to the proper limits. Prior to bolting up the connection, electrical joint compound shall be brushed on the contact faces of the electrical joint.

2. All motor lead connections shall be made up to match the type of lead furnished on the motor. If the lead is not lugged, then twist-on wire connectors may be used. To prevent possible vibration problems, twist-on connectors shall be taped after installation.

3. All lugged motor lead connections (excluding motors over 200 horse-power) shall be made up using ring tongue compression lugs with proper size stainless steel nuts and bolts. Belleville type spring shall be used to maintain tension on the connections. The connections shall then be insulated using the procedure described for irregular shapes, utilizing rubber tape in conjunction with vinyl electrical tape.

4. At the time of final inspection, the Engineer may request the Contractor to disassemble 3 randomly selected motor lead connections in the Engineer's presence, to assure conformance with these Specifications.

5. The Contractor shall include all necessary tools, materials, and labor in his bid for disassembly of the connections and for remaking them with new insulating materials after inspection.

END OF SECTION

SECTION 16220
MOTORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Motors are to be furnished with driven equipment except where otherwise noted on the Contract Drawings or elsewhere in this Division of the Specifications. All motors shall conform to the following Specifications and any special requirements of the driven equipment. Special requirements of the driven equipment shall take precedence over these Specifications should a discrepancy occur. Starting torque and slip ratings shall conform to the requirements of the driven equipment.

B. Polyphase motors shall be of the squirrel cage induction type and single phase of the capacitor start-induction run type except as otherwise noted. Conduit boxes shall be tapped for the size conduit shown on the Contract Drawings.

C. All motors shall be manufactured and installed in accordance with applicable NEMA standards and NEC provisions, latest revisions.

1.02 RELATED WORK

A. Division 11

B. Section 16010 – General Electrical Requirements

1.03 SUBMITTALS

A. Submittals are required in accordance with Section 16010 requirements.

1.04 DELIVERY, STORAGE, & HANDLING

A. All electrical motors shall be protected against the accumulation of moisture, dust and debris and physical damage during the course of installation of the job.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Motors - “General Electric”, “Westinghouse”, “U.S. Motors”, “Gould Century”, “Lincoln”, “Baldor”, “Marathon”, “Reliance”, “Magnatek”, “Siemens”, or equal.

2.02 EQUIPMENT

A. Motors 200 Horsepower and Under for Service Under 600 Volts

1. Ratings and Electrical Characteristics

a. Time: All motors shall be rated for continuous duty.

b. Temperature: Based on NEMA standards for a maximum ambient temperature of 40 degrees Celsius and an altitude of 3,300 feet or less, according to service factor and insulation class employed.

c. Voltage: All single phase motors shall be rated 115/208/230 volts and all polyphase motors 230/460 volts. Submersible polyphase motors to be operated at 460 volts may take exception to the dual voltage requirement. All motors shall be capable of normal operation at balanced voltages in the range of ±10 percent from rated winding voltage.

d. Frequency: All a-c motors shall be rated for 60 Hz. operation. All motors shall be capable of normal operation at frequencies 5 percent above or below the nominal rating of 60 Hz.

e. Horsepower: Horsepower of the motors shall be as given in the Specification Division on the driven equipment or as shown on the Contract Drawings. Submersible motors shall be allowed to be furnished even though the horsepower rating may not be in accordance with standard NEMA assignments. In many cases, the horsepower specified is a minimum requirement and certain alternate manufacturers may require larger horsepower motors. The larger motor shall be furnished at no extra cost to the Owner.

f. Locked Rotor Current: Locked rotor current shall be in accordance with NEMA standards.

g. Efficiency and Power Factor: Efficiency and power factor shall be given consideration during Shop Drawing review. The ratings at full, ¾, and ½ load shall be compared to similar motors manufactured by acceptable suppliers listed in these Specifications. Excessive variation shall be considered grounds for rejection.

h. Speed: Synchronous speed of motors shall correspond to standard NEMA ratings. Actual speed shall be as given in the Specification Division on the driven equipment. Slip shall not exceed 5 percent at full load.

i. Service Factor: The service factor shall be 1.15 unless requirements of the driven load necessitate a higher service factor.

j. Insulation Class: Insulation shall be NEMA Class B, except as otherwise noted. Motors to be operated at variable speed shall be Class F and shall be listed inverter-duty. Class F insulated motors shall operate at a Class B rise at nameplate horsepower loading.

k. Design Level: Motors shall be NEMA design B, except as otherwise noted.

l. Enclosure: Motors for process equipment 2 HP and smaller shall be totally enclosed. All motors for process equipment larger than 2 HP shall be TEFC (totally enclosed fan cooled), suitable for use indoors or outdoors, except as otherwise noted. Totally enclosed non-ventilated (or air-over) motors may be used for ventilators and other auxiliary equipment that by virtue of the load are provided with more than adequate ventilation. ODP (open dripproof) motors may be used for ventilators where the motor is outside the air stream yet still protected from the weather. Division 15 of the Specifications and the HVAC Contract Drawings will detail the type of enclosure required for ventilators.

m. Frame Size: Frame designations shall be in accordance with NEMA standards.

n. Winding Overtemperature Sensors: All motors 15 to 200 HP shall be provided with motor winding thermostats. The devices shall be hermetically sealed, snap-acting thermal switches, actuated by a thermally responsive bi-metallic disk. A minimum of 1 per phase is required, with switches wired into the control circuit of the starter to

provide de-energization should overheating threaten. Also all motors from 3-200 HP operated by adjustable frequency drives shall have motor winding thermostats.

o. Any motors indicated on the Drawings to be controlled by a variable frequency drive shall be rated inverter-duty. If over 20 HP they shall include shaft/bearing grounding rings equivalent to Aegis Pro SLR series with debris/dust barrier.

2. Mechanical Characteristics

a. Integral Horsepower Motor Construction

(1) Motor frames for horizontal motors shall be cast iron, heavy fabricated steel, or cast aluminum (alloy 356 or 360). A steel insert ring shall be set into the aluminum alloy endshield when cast to minimize wear of the bearing support. Aluminum alloy motors shall not be used in areas where exposed to chlorine gas.

(2) Motor frames for vertical motors shall be cast iron, heavy fabricated steel, or extruded aluminum (alloy 6063-T4 or 6063-T6). Endshields for vertical motors must be cast iron.

(3) If an aluminum frame is used, the endshields and/or all other steel hardware must be plated with zinc or cadmium and coated with grease before assembly to minimize the galvanic action between the steel and aluminum.

(4) Motor frames and endshields shall be of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type enclosure employed. Lifting lugs of all motors shall conform to NEMA standards.

(5) Windings shall be random or form wound, adequately insulated and securely braced to resist failure due to electrical stresses and vibration. If the windings are aluminum, there shall be a cold welded aluminum-copper transition joint at the termination of the windings to permit the use of standard copper to copper connection techniques by the electrician and to prevent galvanic action between the copper power wires and the aluminum windings.

(6) The motor shaft shall be made of high grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of that particular rating. Bearing journals shall be ground and polished.

(7) Rotors shall be made from high grade steel laminations adequately fastened together and to the shaft. Rotor cage windings may be cast aluminum of bar type construction with brazed end rings.

(8) Integral horsepower motors shall be equipped with cone, roller, or ball bearings made to AFBMA standards, Grade 1 and shall be of ample capacity for the motor ratings. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent relubrication (ten years normal operation without lubrication), but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight running fits or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of lubricant out of the bearing cavity.

(9) See the specification division relating to each piece of motor driven equipment for additional motor requirements to those listed above.

b. Fractional Horsepower Motor Construction

(1) Motor and shell shall be rigid welded steel designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight, die cast aluminum. Windings shall be of varnish insulated wire with slot insulation of polyester film and baked on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses, and other hazards. Motor shafts shall be made from high grade, cold rolled, shaft steel with drive shaft extensions carefully machined to standard NEMA dimensions for shaft coupled drive connection. Bearings shall be carefully selected precision ball bearings with extra quality, long life grease and large reservoir providing 10 years normal operation without relubrication, AFBMA Grade 1.

3. Tests, Nameplates, and Shop Drawings

a. Tests

(1) Tests shall be required on integral horsepower motors only. A factory certified test report of "electrically duplicate motors previously tested" shall be supplied on all motors under 200 horsepower. The test shall be certified by the factory and shall contain a statement to the effect that complete tests affirm the guaranteed characteristics published in the manufacturer's catalogs or descriptive literature.

(2) Tests will be in accordance with IEEE test procedures.

b. Nameplates

(1) Each motor shall have a permanently affixed nameplate of brass, stainless steel, or other metal of durability and corrosion resistance. The data contained on the nameplate shall be in accordance with NEMA standards.

(2) Submersible pump motors and other motors in difficult-to-access locations shall be furnished with a spare nameplate for mounting inside the MCC or starter enclosure.

c. Shop Drawings

(1) Shop Drawings shall consist of motor dimensions, nameplate data from each motor and tests as outlined above. Also included shall be efficiency and power factor at 100, 75, and 50 percent load. Operation, maintenance, and lubrication information (including bearing catalog numbers) shall be submitted with Shop Drawings for review.

4. Efficiency Requirements

a. NEMA premium efficiency or IEC 60034-30 Level IE3 efficiency levels shall be the minimum acceptable levels as follows.

Minimum Efficiency Requirements (%)			
	Nominal 1200 RPM	Nominal 1800 RPM	Nominal 3600 RPM
1	82.5	85.5	77.0
1.5	87.5	86.5	84.0
2	88.5	86.5	85.5
3	89.5	89.5	86.5
5	89.5	89.5	88.5
7.5	91.0	91.7	89.5
10	91.0	91.7	90.1
15	91.7	92.4	91.0
20	91.7	93.0	91.0
25	93.0	93.6	91.7
30	93.0	93.6	91.7
40	94.1	94.1	92.4
50	94.1	94.5	93.0
60	94.5	95.0	93.6
75	94.5	95.4	93.6
100	95.0	95.4	94.1
125	95.0	95.4	95.0
150	95.8	95.8	95.0
200	95.8	96.2	95.4

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Installation of motors shall comply with motor manufacturer instruction's as well as applicable NEMA recommendations and requirements of the driven equipment OEM (original equipment manufacturer).

B. Motors shall be aligned to acceptable tolerances and shall not vibrate excessively.

C. Motors shall not be energized until they have been accepted by the OEM start up personnel.

END OF SECTION

SECTION 16280
SURGE PROTECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide surge protection devices (SPDs) for distribution equipment (switchboards, motor control centers, and panelboards) as indicated on the Drawings and as specified herein.

B. Provide surge protective devices (SPDs) for other systems and equipment as indicated on the Drawings, as specified herein, and as specified in individual Specification sections in Division 16 and 17.

1.02 RELATED WORK

A. Section 16010 – General Electrical Requirements

B. Section 16670 - Lightning Protection Systems

C. Section 16442 - Panelboards

D. Section 17100 – Instrumentation

E. Section 17200 – SCADA Hardware

1.03 SUBMITTALS

A. Submit product data on all surge protective equipment. Catalog data shall include all information necessary to prove compliance with this Specification. Proposed part numbers and options shall be flagged, and non-applicable equipment shall be crossed out. Provide a table of each suppressor location. Installation instructions and drawings shall also be included with the shop drawing submittal.

B. Clearly note all options being submitted with underlines in product literature. Provide a list for each model number of suppressor and corresponding service used.

C. SPD specifications shall include UL 1449 surge suppression ratings.

D. Submit operation and maintenance information on all surge protective equipment.

1.04 REFERENCES

A. ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

B. ASTM A 153/A 153M (2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

C. IEEE C62.11 (latest version) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

D. NEMA LA 1 (latest version) Standard for Surge Arresters

E. NFPA 70 (latest version) - National Electrical Code

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Switchboard, MCC, and Panelboard SPDs – Eaton, Square D, GE, Siemens, or equal.

B. Misc. Equipment and Instrumentation SPDs - "Phoenix Contact," "Eaton," "ABB," "Transtector," or equal.

2.02 GENERAL REQUIREMENTS

A. Surge protection equipment operating temperature shall be –20°F to 125°F, minimum range.

B. SPD equipment shall be UL 1449 listed.

2.03 DISTRIBUTION EQUIPMENT SPD

A. The SPD shall be suitable for application in category C3 environments as described in ANSI/IEEE C62.41. The SPD shall be of parallel design and provide protection, line to ground, neutral to ground, and line to neutral for wye or delta distribution systems. The SPD shall be compatible with the indicated electrical system, voltage, current and distribution configuration.

B. Non-listed manufacturers shall submit oscillographs and/or computer generated graphs from compatible smartscopes, which demonstrate SPD clamping voltage values when tested to category C3 (per ANSI/IEE C62.45) 6kV 1.2x50 microseconds and 10kA 8x20 microseconds test waveshapes, in all specified suppression modes.

C. SPD shall comply with ANSI/IEEE C62.1, C62.41, and C62.45. The SPD shall be capable of surviving 1,000 sequential category C3 surges without failure following IEEE test procedures established in C62.45.

D. SPD shall have 200kA short circuit current ratings. SPD shall have thermal disconnects to protect against overvoltage conditions.

E. The SPD shall have LED indicators that provide indication of suppression failure.

F. The SPD maximum continuous operating voltage (MCOV) shall be capable of sustaining 110 percent of the nominal RMS voltage continuously without degradation.

G. The SPD shall use only solid state clamping components to limit the surge voltage.

H. Distribution Panelboard SPD shall have a surge current capacity of 80,000 amps minimum per mode.

I. The SPD shall have a response time no greater than 5 nanoseconds, for any of the individual protection modes, under laboratory conditions with optimum lead lengths.

J. The SPD UL 1449 surge suppression rating for any suppression mode shall not exceed:

Electrical System Voltage	Phases	UL 1449 Surge Suppression Ratings
120/240	1	330V
120/240	3	330V
120/208	3	330V
208	3	700V
277/480	3	700V
480	3	1500V

K. EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

L. The SPD components shall have a SPDT alarm contact rated for 250 VAC, 1 amp (minimum) used for remote indication of circuit integrity.

M. SPD shall be equipped with a non-resettable digital event counter readable on the face of the suppressor without opening any doors or covers.

2.04 CABINET/CONTROL PANEL SPD

A. The SPD shall be a Din-Rail-Mounted device and shall be installed to protect the equipment in the cabinet from harmful surges and voltage spikes. The SPD shall have a SPDT contact rated for 250 VAC, 1 amp used for remote indication/visual indicator of circuit integrity.

B. It shall have a surge handling capacity of 10kA (8/20microsecond) minimum. It shall have hybrid technology for “fine” voltage clamping and “coarse” surge current handling. The clamping voltage shall be less than or equal to 500V. The response time shall be less than or equal to 25 nanoseconds.

C. The device shall be a Phoenix Contact “Valvetrab” or equal.

2.05 INPUT/OUTPUT SPD

A. Analog I/O SPD

1. The Din-Rail-Mounted surge protection device shall be installed to protect the analog I/O.

2. The device shall have a surge handling capacity of 20kA (8/20microsecond) minimum. It shall have hybrid technology for “fine” voltage clamping and “coarse” surge current handling. The clamping voltage shall be less than or equal to 40V (Conductor to conductor) and 450V (conductor to ground). The response time shall be less than or equal to 1 nanosecond (conductor to conductor) or 100 nanoseconds (conductor to ground). The resistance of the device shall be no more than 2.2 ohms.

3. The device shall be suitable for din-rail mounting, and shall be no more than 17.5 mm thick.

4. The device shall be suitable for use on a 4-20mA analog circuit with 28VDC continuous operating voltage and up to 450mA continuous current.

5. The device shall be a Phoenix Contact "MCR-Plugtrab PT" surge protection device, or equal.

B. Digital 24VDC I/O SPD

1. The SPD shall be DIN-rail-mountable and shall be installed to protect the digital 24VDC I/O.

2. The device shall have a surge handling capacity of 10kA (8/20microsecond) minimum. It shall have hybrid technology for "fine" voltage clamping and "coarse" surge current handling. The clamping voltage shall be less than or equal to 42VDC. The response time shall be less than or equal to 25 nanoseconds. The resistance of the device shall be no more than 4.7 ohms.

4. The device shall be suitable for use on 24VDC circuit with up to 300mA continuous current.

5. The device shall be a Phoenix Contact "MCR-Plugtrab PT" surge protection device, or equal.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. The conductors shall be as short and straight as practically possible and shall not exceed 6 feet in length or the manufacturer's maximum recommended length (whichever is less). The input conductors are to be twisted together to reduce the SPD system inductance. An appropriately sized manual safety/disconnect switch or thermal magnetic circuit breaker shall be installed on the line side of the SPD. It shall be capable of electrically isolating the SPD from the electrical service for repair without interrupting service to the building.

B. The SPD shall be installed following the SPD manufacturer's recommended practices and in compliance with all applicable codes.

3.02 DISTRIBUTION EQUIPMENT SPD

A. SPD shall be manufacturer-installed where indicated on the Drawing panelboard schedules and one-line/riser diagrams.

3.03 CABINET SPD

A. Provide a Cabinet SPD on all single phase control panels, SCADA and electronic cabinets, and all other equipment with solid-state circuitry.

3.04 INPUT/OUTPUT SPD

A. Provide SPDs on each analog and digital I/O termination in the cabinet where indicated in the I/O table.

END OF SECTION

SECTION 16440
MOTOR CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Contractor shall furnish and install motor control equipment as specified herein and as shown on the Drawings.

B. Provide manufacturer startup services for any motor control equipment that requires configuration or programming (frequency drives, adjustable breakers, power monitor, etc.)

1.02 RELATED WORK

A. Section 16010 – General Electrical Requirements

B. Section 16483 – Adjustable Frequency Drives

1.03 SUBMITTALS

A. Motor control equipment shall be new and the equipment of one manufacturer. Each component is specified by a particular trade name; however, this does not relieve the Contractor of the responsibility of submitting descriptive literature and Shop Drawings for review of all components. Motor control shall be the same brand as power distribution equipment on projects with both.

B. Shop drawings, including layout drawings, complete schematic and composite wiring diagrams, control circuit wiring diagrams and descriptive literature shall be submitted to the Engineer for review. Service manuals shall be submitted on all equipment and shall be bound in 3-ring looseleaf binders. The manuals shall also include information on accessories such as timers, etc., built in the control center.

C. Shop Drawings shall be clearly marked and or highlighted as to which product, type, option, etc. is being submitted. Product literature with one or more styles / configurations for a single product shall have a written description of use for each of the styles / configurations represented on the literature. For example: Device boxes – Styles shall be listed as: For masonry walls, for electrical devices, for ceiling mounted light fixtures, etc

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Control Equipment

1. “Square D”, “Eaton”, “General Electric”. “Allen-Bradley” or equal.

2.02 MOTOR CONTROL CENTERS (MCC)

A. General

1. Quality of built-in transformers, starters, lighting panelboards, timers, etc. shall be as written elsewhere in this Division unless otherwise noted.

2. Motor Control Center(s) shall consist of one or more enclosed vertical sections joined together to form a rigid, free standing assembly. The construction of the Motor Control Center shall meet the requirements set forth by Underwriters' Laboratories publication UL-845, NEMA publication number ICS-2-322, the National Electrical Code, and color coded.

3. The structure shall be UL listed and labeled as service equipment if applicable. All sections shall bear UL labels.

4. Enclosures shall be NEMA 1 unless otherwise indicated, and each control center suitable for connection to an available fault current of 42,000 RMS symmetrical amperes.

B. Construction

1. Vertical Sections

a. Vertical sections shall support the horizontal and vertical buses, combination starter units, covers and doors, and shall be designed to allow for easy rearrangement of units by the purchaser. Vertical sections shall have structural supporting members formed of a minimum of 13 gauge hot-rolled steel. All finished surfaces shall be blemish-free. Where needed, reinforcement structural parts shall be of 10-gauge steel to provide a strong rigid assembly. Each section shall be 90 inches high and shall have 7 gauge steel, 3 inch high removable lifting angle and two 1 ½ inch high base channels. Complete control center line-ups shall be divided into shipping splits no wider than approximately 60 inches. The lifting angle shall be provided on the top of each shipping split and shall extend the entire width of the shipping split. Lifting angles shall be designed to support the entire weight of the MCC section. Base channels shall be provided with holes to permit bolting the Motor Control Center(s) to the floor. The entire assembly shall be constructed and packaged to withstand all stresses induced in transit and during installation.

b. Motor Control Centers shall be designed so that matching vertical sections of the same current rating and manufacture can be added later at either end of the line-up without use of transition sections and without difficulty or undue expense. Removable end closing plates shall be provided to close off openings on the end of the Motor Control Center line-up. A removable top plate shall be provided on each vertical section and shall be of one piece construction for added convenience in cutting conduit holes. The design shall allow use of the standard conduit entrance area without significant sag or deformation of the top plate.

c. Vertical sections shall be designed to accommodate plug-on units in front-of-board or back-to-back construction as shown on Contract Drawings. Vertical sections housing plug-on units shall be 20 inches wide and shall be 20 inches deep. Wider sections will be permitted only for bolted connection type units not fitting the 20 inch wide sections. Unit mounting area shall be divided into ½ space factor divisions, each approximately 6 inches. NEMA Size 1 and 2 combination starter units shall use only 1 space factor, or 12 inches, of unit mounting space. Vertical sections shall allow for 6 space factors of unit mounting space. Removable blank plates shall cover all unused unit mounting spaces. Blank plates shall be flanged on all 4 sides and shall be mounted with captive screws. Blank space shall be equipped for future use.

d. Vertical sections shall be provided with both horizontal and vertical wireways. Sufficient clearances shall be provided in the horizontal wireway so that no restriction is encountered in running wires from the vertical to horizontal wireway. Wireways shall be in accordance with the wireway sections contained in this document.

2. Horizontal Wireways

   a. Horizontal wireways shall be provided in the top and bottom of each vertical section as indicated in the Contract Drawings and shall be arranged to provide full length continuity throughout the entire assembly. The top horizontal wireway shall have a cross sectional area of not less than 20 square inches with openings between sections of not less than 11 ½ square inches. The bottom horizontal wireway shall extend through the length and depth of the vertical sections and shall also be provided with openings of not less than 11 ½ square inches to allow for full length continuity throughout the entire assembly. The bottom horizontal wireway height shall be not less than 6 inches. Covers for all wireways shall be equipped with captive type screws to prevent loss of hardware during installation. All wireways shall be isolated from the bus bars.

3. Vertical Wireways

   a. A vertical wire trough shall be located on the right -hand side of each vertical section and shall extend from the top horizontal wireway to the bottom of the available unit mounting space. Each vertical wire trough shall have a cross sectional area of not less than 19 square inches and shall be isolated from the bus bars to guard against accidental contact. A separately hinged door having captive type screws shall cover the vertical wire trough to provide easy access to control wiring without disturbing control units.

4. Busbars

   a. A continuous main three-conductor horizontal bus shall be provided over the full length of the control center. If a 4th neutral wire is called for on the Drawings, then a fully rated horizontal neutral bus (1200 ampere maximum) shall also be supplied over the full length of the Motor Control Center. When necessary, the bus shall be split to allow for ease in moving and handling. Splice bars will be supplied to join the bus wherever a split has been made. All splice connections shall be made with at least two bolts and shall employ the use of Belleville washers in the connection. Horizontal bus bars shall be mounted edgewise and supported by insulated bus supports.

   b. For distribution of power from the main horizontal bus to each unit compartment, a three-phase vertical bus shall be provided. The vertical bus shall be firmly bolted to the horizontal bus for permanent contact.

   c. The main horizontal and vertical buses shall be made of copper and the entire length shall be electrolytically tin plated to provide maximum protection to the bus bars from normal or adverse atmospheric conditions.

   d. Bus supports shall be formed of high strength glass reinforced alkyd material. Bus supports shall have generous surface clearances in the vertical plane to shed dust and maintain dielectric integrity. Bus supports and insulators shall be red to indicate proximity of energized bus parts.

   e. Horizontal and vertical buses shall have continuous current ratings adequate to handle all loads as shown on the one line diagram in the Contract Drawings. Continuous current ratings shall be in accordance with temperature rise specifications established by UL, ANSI, and NEMA standards.

   f. A copper ground lug shall be provided in each incoming line vertical section capable of accepting a #8 to 250 MCM cable. A horizontal copper grounding bus shall be

provided in each section of the Motor Control Center. Horizontal grounding bus shall run continuously throughout the control center except where splits are necessary for ease of shipment and handling in which case splice bars shall be provided. Grounding bus shall be tin plated copper and have a cross sectional area equal to 28% of the main horizontal bus cross sectional area. Horizontal ground bus shall be located at the bottom of the Motor Control Center.

5. Bus Barriers

   a. Insulated horizontal and vertical bus barriers shall be furnished to reduce the hazard of accidental contact with the bus. Vertical bus barriers shall have interlocking front and back pieces to give added protection on all sides and shall segregate the phases to reduce the possibility of accidental "flash over". Small, separate openings in the vertical bus barriers shall permit unit plug-on contacts to pass through and engage the vertical bus bars. Bottom bus covers shall be provided below the vertical bus to protect the ends of the bus from accidental contact with fish tapes or other items entering from the bottom of the enclosure. Unused plug-on openings in the bus shall have plastic snap-in closing plates for added safety.

6. Main Incoming Lug Compartment

   a. A front accessible main lug compartment shall be provided with suitable main lugs to accommodate the number of cables per phase as indicated on the Contract Drawings. The compartment shall be located in the top most or bottom most unit space of the section to accommodate the user's cables entering the Motor Control Center as indicated on the Contract Drawings. The main incoming lug compartment shall be covered by a hinged door for maintenance access. This door shall be held closed with captive type screws to discourage unauthorized access. (A unit door padlock attachment shall also be provided to lock the door in the closed position with one 5/16 inch diameter shackle padlock. This attachment shall also accept a meter type seal.)

7. Units

   a. Combination starter units shall consist of Size 1 minimum full voltage magnetic starters, molded case magnetic-only circuit breakers, and auxiliary control devices, as required and/or shown on the one-line and elementary diagrams. Pilot light assemblies (push-to-test) shall be LED type. All auxiliary equipment, except that which is specified for mounting on the door, shall be mounted within the compartment. All units shall be provided with unit doors, unit support pans, unit saddles and unit disconnect operators as outlined in this Specification. Each unit compartment shall be enclosed and isolated from adjacent units, buses and wireways except for openings for conductor entrance into units. Units shall be designed and constructed so that any fault will be localized within the compartment. All units shall be UL listed for minimum of 42,000 amperes RMS symmetrical fault withstand ability.

   b. Plug-on combination starter units of the same NEMA size and branch feeder units of the same trip size shall be readily interchangeable with each other. It shall be possible to withdraw each plug-on unit to a de-energized position with the unit still being supported by the structure. It shall be possible to lock the unit in this position with one padlock.

   c. Full voltage non-reversing combination starter units shall have the following minimum space factor requirements, shall be provided with plug-on connections and shall be provided with ample space for customer wiring room:

	Circuit Breaker Space Factor
Size 1	1
Size 2	1
Size 3	1 ½
Size 4	2

8. Unit Plug-On

   a. For convenient unit connection to bus bars, unit plug-on contacts shall be provided on the following units:

      (1) For circuit breaker type units; full voltage starters, size 4 and smaller; branch circuit units, 225 ampere and smaller.

   b. The plug-on connection for each phase shall be of a high quality two point connection and shall be designed to tighten around the vertical bus bar during a heavy current surge. For trouble-free connections, the plug-on fingers shall be tin-plated and coated with a compound to assure a low resistance connection. Contact fingers shall be of a floating and self-aligning design to allow solid seating onto the vertical bus bars.

   c. Starters NEMA size 4 and larger shall bolt directly to the vertical bus bars, circuit breakers rated higher than 225 amps shall also bolt directly to the bus bars.

9. Unit Doors

   a. Each unit shall have a door securely mounted with rugged concealed-type hinges which allow the door to swing open a minimum of 112° for unit maintenance and withdrawal. Doors shall be fastened to the structure so that they remain in place when a unit is withdrawn and may be closed to cover the unit space when the unit has been temporarily removed. Doors shall be held closed with quarter-turn fasteners. Each unit door shall be interlocked with its disconnect mechanism to prevent the door from opening when the unit is energized. A defeater mechanism shall be provided for defeating this interlock by authorized personnel. Removable door panels shall be provided on starter unit doors for mounting push buttons, selector switches or pilot lights. Blank door panels capable of accepting future pilot devices shall be furnished when pilot devices are not originally specified for starter units. Each starter unit door shall house an external low-profile overload reset button for resetting the overload relay in the event of tripping.

10. Unit Support Pan

   a. Each plug-on unit shall be supported and guided by a removable pan so that unit rearrangement can be easily accomplished. For easy unit installation and rearrangement, transfer of this unit support pan from one location to another shall be accomplished with ease after the control unit and door have been removed.

11. Unit Saddles

   a. Each plug-on unit shall have a saddle of 14 gauge hot rolled steel designed and constructed to physically isolate the unit from the bus compartment and adjacent units. Saddles shall be equipped with captive, self-aligning mounting screws which shall hold the unit securely in place during shipment. Flanged edges shall be provided

on each saddle to facilitate unit removal, or alternately provide a mechanical cam lever to facilitate removal.

12. Disconnect Operators

a. An external operator handle shall be supplied for each switch or breaker. This mechanism shall be engaged with the switch or breaker at all times regardless of unit door position to prevent false circuit indication. The operator handle shall be color coded to display red in the “ON” position and green in the “OFF” position. For added safety it shall be possible to lock this handle in the “OFF” position with up to three padlocks. The operator handle shall be interlocked with the unit door to prevent switching the unit to “ON” while the unit door is open. A defeater mechanism shall be provided for the purpose of defeating this interlock by a deliberate act of an electrician should he desire to observe the operation of the operator handle assembly or the unit components. Operators shall not be higher than 6'-6" above finished floor elevation, as installed.

13. Wiring

a. The motor control center wiring shall be type MTW, NEMA Class II, Type B.

b. All wiring to the terminal strips from outside the MCC shall be made with spade type terminals of the proper size and rating for the wire used. Pull apart terminal blocks shall be provided in unit spaces of motor starters that contain field wiring energized from a remote source to comply with NEC Article 430-74.

c. Each individual control conductor must be labeled and the labels must match the shop drawings and O&M manuals.

14. Finish

a. The finish shall be manufacturer’s standard gray enamel applied over a rust inhibiting phosphate primer.

15. Optional Modifications and Accessories

a. Additional modifications and accessories shall be as listed and specified on the Contract Drawings.

16. Identification

a. A control center identification nameplate describing section catalog numbers and characteristics shall be fastened on the vertical wire trough door of every section. Each control center unit shall have its own identification nameplate fastened to the unit saddle. These nameplates shall have suitable references to factory records for efficient communication with supplier. Each control center unit shall also have an engraved Bakelite nameplate fastened to the outside of each unit door inscribed as written on the Contract Drawings for ease in identification and for making changes when regrouping units. An overall structure nameplate is also required.

C. Overcurrent Protective Devices

1. Circuit Breakers

a. All breakers sized 600A frame and larger shall have adjustable trip elements with the following adjustments: Long time pickup & delay, short time pickup & delay, Instantaneous, Ground fault pickup & delay.

b. Molded case circuit breakers with fixed thermal-magnetic trip units shall be furnished for 400A frame and smaller branch feeder units. All circuit breakers shall have a push-to-trip test feature for testing and exercising the circuit breaker trip mechanism.

c. All breakers for starters or drives shall be motor circuit protector type and have an adjustable magnetic trip element.

D. Lighting Panelboards

1. Lighting panelboards shall be as specified in other section of this Division. Lighting panelboard unit doors shall be held closed with captive latches that may easily be operated without the use of tools, i.e., wing nuts, handle, etc.

E. Electronic Circuit Monitors

1. Circuit Monitor Installation

a. Electronic circuit monitors shall be installed by the equipment manufacturer for all circuits as indicated on the Contract Drawings.

b. All control power, CT, PT, and communications wire shall be factory installed and harnessed within the lineup.

c. Where external circuit connections are required, terminal blocks shall be provided and the manufacturer's shop drawings must clearly identify the interconnection requirements, including wire type, to be used.

d. This equipment shall be Schneider Power Logic, Eaton, General Electric, or equal. Provide a power meter with Ethernet/IP communications, waveform capture with minimum 128 samples/cycle for 8 cycles, Schneider Powerlogic PM5650 or equal. A CT is required for all 3 phases and the neutral.

2. Circuit Monitor Characteristics

a. The electronic circuit monitors shall accept inputs from industry standard instrument transformers (1 20 VAC secondary PTs and 5A secondary CTs). CTs are required on all three phases, and the neutral.

b. The current and voltage signals shall be digitally sampled at a rate high enough to provide accurate rms sensing and valid data for waveform analysis beyond the 30th harmonic (fundamental of 60 Hz).

c. All setup parameters required by the circuit monitors shall be stored in nonvolatile memory (no battery backup) and retained in the event of a control power interruption.

d. The circuit monitor shall also maintain, in nonvolatile memory, a maximum and minimum value for each of the instantaneous values reported, as well as the time and date of the highest peak for all of the peak demand readings.

e. The circuit monitors shall be equipped with an integral LED display to provide local access to metered quantities.

f. The following instantaneous readings shall be reported by the circuit monitor:

(1) Frequency
(2) Temperature
(3) Current, per phase rms
(4) Current, 3-phase average rms
(5) Current, apparent rms
(6) Voltage, phase-to-phase & phase-to-neutral
(7) Power factor, per phase
(8) Power factor, 3-phase total
(9) Real power, 3-phase total
(10) Reactive power, 3-phase total
(11) Apparent power, 3-phase total

g. The following demand readings shall be reported by the circuit monitor:

(1) Average demand current, per phase
(2) Peak demand current, per phase
(3) Average demand, real power
(4) Predicted demand, real power
(5) Peak demand, real power

h. The following energy readings shall be reported by the circuit monitor:

(1) Accumulated energy
(2) Accumulated reactive energy

3. Waveform Capture Capability

a. All electronic circuit monitors shall include waveform capture capability.

b. Upon a user-initiated command, the circuit monitor shall capture and store, in nonvolatile memory, 3-phase voltage and current samples consisting of 128 data points per cycle over 8 cycles.

c. These samples shall be evenly gathered from three voltage and three current phases such that the original power signals with proper magnitude and phase relationships may be reconstructed.

d. It shall be possible to recreate the original power signal from the stored data with sufficient accuracy such that steady-state power harmonic analysis will provide valid information on harmonic content for up to the 30th harmonic of the fundamental power frequency.

4. Connecting and Networking Circuit Monitors

a. All data and calculated values stored in the circuit monitor shall be accessible to external devices by means of an Ethernet/IP communications port built into the circuit monitor.

5. System Display

a. The circuit monitor shall include an LED readout which will allow local display of the following electrical parameters:

(1) Current, per phase rms
(2) Voltage, phase-to-phase & phase-to-neutral
(3) Real power, 3-phase total
(4) Reactive power, 3-phase total
(5) Apparent power, 3-phase total
(6) Power factor, 3-phase total & per phase
(7) Frequency
(8) Peak demand current, per phase
(9) Peak demand, real power
(10) Accumulated Energy, (MWH and MVARH)
(11) Total harmonic distortion, current & voltage

b. Reset of the following electrical parameters shall also be allowed from the front of the circuit monitor:

(1) Peak demand current
(2) Peak demand power
(3) Energy (MWH)
(4) Reactive energy (MVARH)

c. Circuit monitor setup for system requirements shall be allowed from the front of the circuit monitor. Setup provisions shall include:

(1) CT rating (xxxx:5)
(2) PT rating (xxxx:120)
(3) System type (3-wire and 4-wire)
(4) Demand interval (5-60 min.)

d. All reset and setup functions shall be keyswitch-protected to prevent unauthorized/accidental changes.

e. System display units shall be installed by the manufacturer in the equipment as indicated on the drawings.

f. The system display units shall be flush mounted on door panels.

g. The system display unit shall utilize a 4-line by 20-character, high contrast LCD technology display with backlighting to provide high reliability and superior readability in all light conditions.

2.04 INDIVIDUALLY MOUNTED MOTOR CONTROL DEVICES (480, 240, OR 120 VOLT)

A. General

1. All motor control equipment shall be new and the product of 1 manufacturer. All individually mounted disconnects, push-button stations, latchout stations, starters, etc., shall be mounted on a 1 inch strut to provide an air space at rear.

B. Starters

1. General

a. All starters shall be of the voltage rating, type, and sized for the motor size shown in these Specifications and/or on the Contract Drawings. For enclosure type see the system operation description and/or the Contract Drawings. All starters shall be of the magnetic type. Should a piece of electrically driven equipment be furnished with

a larger motor than shown on the Contract Drawings, the proper size combination starter shall be provided for the equipment supplied, at no extra cost to the Owner.

b. See the Contract Drawings for the auxiliary equipment to be furnished and/or Section 16900 - Controls of this division. Maximum control voltage shall be 120 volts, a-c. Minimum starter size shall be NEMA Size 1.

2. Overloads

a. Each starter shall have a thermal overload device in each ungrounded leg. The overload shall be of the "Ambient compensated adjustable solid-state" type.

3. Contactors

a. All contactors for motor starters shall be of the a-c magnetic type with "undervoltage" protection when used in conjunction with momentary contact push-button control and "undervoltage" release when used with maintained contact push-button control.

b. Contactor size shall be in accordance with NEMA Standards for the motor controlled and shall be horsepower rated.

c. Contacts shall be of the heavy duty silver-to-silver type and shall be totally enclosed in individual arc quenching chambers. Contacts shall be easily accessible for replacement.

d. The contactor coil shall be of the vacuum impregnated or epoxy resin type, moisture resistant and corrosion proof.

C. Control Stations

1. General

a. Control stations shall be heavy duty, maintained or momentary contact type, as noted on the Contract Drawings. Contacts shall be silver alloy, double break type. The number and marking of controls shall be as shown on the Contract Drawings. Enclosures shall be NEMA 4X for indoor and outdoor mounting, unless otherwise noted on the Contract Drawings. All control stations shall operate on 120 volt, a-c maximum, unless otherwise designated on the Contract Drawings. "Latch-out" facilities shall be provided where called for in these Specifications and/or on the Contract Drawings.

2. Maintained Contact

a. Maintained contact control switches shall be marked "On" and "Off". The button pushed shall remain in and push the other button out until the other button is pushed. In general, they are to be used for hand control of motors which have to operate continuously and restart whenever power is off then resumed, without any manual operator. This is needed for motors which have to operate continuously in the absence of an operator.

3. Momentary Contact

a. Momentary contact control push-button switches shall be marked "start" and "stop". Pushbuttons shall spring out whenever pushed. If the circuit is dropped for any reason, operation cannot be resumed until a "start" push-button is pushed. In general, they are to be used for hand control of motors which are desired to operate

intermittently in the presence of the operator and stop and start independently from more than one parallel control location.

D. Circuit Breakers

1. Circuit breakers shall be molded case type. Trip elements of multi-pole breakers shall be effectively insulated from one another. Multi-pole breakers shall be designed so that an overload on any one pole shall open all poles simultaneously.

2. The breaker operating mechanism shall be the quick-make, quick-break type and shall be entirely trip free to prevent the contacts being held in a closed position against a short circuit.

3. Breakers not used with motor starters shall be of the thermal magnetic type with a thermal bimetallic element for time delayed overload protection and a magnetic element for short circuit protection.

4. The breaker shall be trip indicating with the trip position midway between the “On” and “Off” positions.

5. Breakers for combination starters shall be 100 amp frame or larger. All breakers for combination starters shall be PowerPacT motor-circuit protector type and have an adjustable magnetic trip element =.

6. Breakers for combination starters shall be F frame or larger. All breakers shall have adjustable magnetic trip elements. Circuit breakers K frame and larger shall have interchangeable thermal-magnetic trip elements.

E. Safety Switches

1. Safety switches shall be of the heavy-duty industrial, quick make, quick-break type. Ratings shall correspond to that of the equipment in which circuit it is used, fuses sized as shown on the Contract Drawings. All safety switches at motor locations are of the nonfused type unless otherwise noted.

2. Safety switches shall have a mechanical door interlock to prevent the door from being opened with the switch in the on position and facilities for locking it in the closed or open position.

3. Safety switches shall be UL98 listed and shall conform to the NEMA KS-1 standard, latest version. NEMA 4X enclosed safety switches where called for shall be stainless steel, or fiberglass.

4. NEMA 1 enclosed switches shall be phosphate coated or equivalent, code gauge steel with baked enamel finish.

5. Safety switches shall include auxiliary contacts to disconnect any motor control circuit power indicated on the Drawings as extending to the motor terminal box (for motor space heaters, embedded winding thermostats, etc.)

F. Selector Switches

1. Hand-off-automatic type selector switches shall be of oil-tight construction and shall have 3 positions. The switch must not have a spring loaded return. It shall be of the “quick-make”, “quick-break” type.
2. Selector switches shall be 30mm, NEMA 4X corrosion resistant, Square D Class 9001 Type SK or equal.

G. Pilot Lights and Pushbuttons

1. Pilot lights shall be 30mm, push-to-test, LED-style, NEMA 4X corrosion resistant, Square D Class 9001 Type SK or equal.
2. Pushbuttons shall be 30mm, NEMA 4X corrosion resistant, Square D Class 9001 Type SK or equal.

H. Manual Motor Starting Switches

Manual motor starting switches for the control of fractional horsepower motors shall be single pole, and shall be provided with a thermal heater of the correct size for the load controlled. Each starting switch shall be mounted where shown on the Contract Drawings. The motor starting switch shall be NEMA rated per the drawings. It shall be fiberglass in chemical or corrosive areas.

I. Timing Relays

Time delay relays shall have an adjustable timing range as shown on the Contract Drawings. The time delay shall be after energizing timer coil. Timing relays shall be Agastat, Square D, or equal.

J. Control Relays

Control relays shall be magnetic, general purpose, "ice cube" type with 3-pole (minimum), double throw contacts rated at 5 amperes (minimum), 120 volts (minimum). Coils shall be rated to operate at the indicated control voltage. Provide proper bases, mounting track, etc. for a complete installation. All relays shall be have a retainer clip, manual operator, and pilot light. Coils connected to solid-state digital outputs shall have transient surge protection.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Motor Control Centers

1. Ends of MCC(s) shall be closed with end plates that include integrated rodent barriers.

3. Each MCC shall be provided with a 4" high concrete pad.

3. One inch air space (min.) shall be allowed between back of MCC(s) and wall surface.

4. Lifting-eyes in tops of MCC(s) section shall be removed (and retained) and the threaded openings closed with stainless cap screws and plastic washers or plastic seals provided for that purpose by the MCC(s) manufacturer.

5. In installations where conduit runs to electrical equipment emanate from the top of MCC(s) there shall be provided additional wiring space in the form of metal trough(s) of the same metal housing(s) dimensions and details. Trough(s) shall be provided by the manufacturer of the MCC(s).

B. Individually Mounted Motor Control Devices (480, 240, or 120 Volt)

1. Each motor disconnect shall be located as near as possible to its respective motor.

2. Remote control station at or near motor shall be mounted near its respective motor, adjacent to the motor disconnect.

3.02 EXTRA STOCK/SPARE PARTS

A. Provide the following spare parts:

10 fuses of each type/amperage used

1 pilot light lamp for each pilot light socket assembly provided

1 control transformer for each size utilized

3.03 MANUFACTURER STARTUP SERVICES

A. Provide a manufacturer representative to commission and startup the equipment. This includes the configuration and programming of the equipment, and furnishing any studies or engineering necessary to properly configure or program the equipment. Submit a field report and as-built documentation.

END OF SECTION

SECTION 16442
PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide panelboards as indicated on the Drawings and as specified herein, including furnishing all labor, materials, equipment, and incidentals required for a complete installation.

B. Circuit breakers of size and type shown on Contract Drawings and described herein shall be provided with the panelboards.

1.02 SUBMITTALS

A. Shop Drawings, including Layout Drawings and complete over current protection devices descriptive literature shall be submitted to the Engineer for review.

B. Shop Drawings shall be clearly marked and or highlighted as to which product, type, option, etc. is being submitted.

C. Circuit assignments noted on the Drawings must match circuit assignments in all panelboards, and must be shown in shop drawings. Do not rearrange circuit numbering unless absolutely necessary due to inability to conform to the Drawings and then only rearrange the necessary breakers to match the Drawings as closely as possible.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. “Schneider/Square D”, “Siemens”, “General Electric,” “Eaton.” Substitution of alternate equipment shall be submitted for review to Engineer 10 days prior to bid.

2.02 EQUIPMENT

A. Rating

1. Panelboard ratings shall be as shown on the Contract Drawings. All panelboards shall be rated for the intended voltage.

B. Standards

1. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. “Standard for Panelboards” and “Standard for Cabinets and Boxes” and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

C. Panelboard Construction

1. Interiors

a. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn

solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

b. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

c. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

d. A nameplate shall be provided listing panel type, number of circuit-breakers and ratings.

2. Bussing

a. Bus-bars for the mains shall be of copper. Full size neutral bars shall be included. Bus-bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

b. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

c. Spaces for future circuit-breakers shall be bussed for the maximum device that can be fitted into them.

d. Separate neutral and ground bus shall be provided, insulated and isolated from each other.

3. Boxes

a. Recessed boxes shall be made from galvanized code gauge steel having multiple knockouts, unless otherwise noted. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides.

b. Surface mounted boxes shall have an internal and external finish as hereinafter specified. NEMA 1 surface mounted boxes shall be field punched for conduit entrances.

c. At least 4 interior mounting studs shall be provided.

4. Trims

a. Hinged doors covering all circuit-breaker handles shall be included in all panel trims.

b. Doors shall have semi flush type cylinder lock and catch, except that doors over 43 inches in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

c. The trims shall be fabricated from code gauge sheet steel.

d. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with manufacturer's standard gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere without cracking or peeling.

e. Trims for flush panels shall overlap the box by at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

D. Overcurrent Protective Devices (Circuit Breakers)

1. Panelboards shall be equipped with circuit-breakers with frame size and trip settings as shown on the Contract Drawings.

2. Circuit-breakers shall be molded case, bolt-in, thermal-magnetic trip.

3. Single Pole Circuit Breakers shall not be tied together to fabricate double or triple pole circuit breakers.

4. Circuit-breakers used in 120/208 volt panelboards shall have an interrupting capacity of not less than 10,000 amperes, RMS symmetrical.

5. Circuit-breakers used in 480 volt panelboards shall have an interrupting capacity of not less than 35,000 amperes, RMS symmetrical.

6. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Contract Drawings. GFCI units shall be 1-pole, 120 volt, molded case, bolt-on circuit-breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the circuit-breaker mechanism. The unit shall be UL listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity of 10,000 amperes RMS.

7. Trip elements of multi-pole breakers shall be effectively insulated from one another. Multi-pole breakers shall be designed so that an overload on any pole shall open all poles simultaneously.

8. The breaker operating mechanism shall be the quick-make, quick-break type and shall be entirely trip free to prevent the contacts being held in a closed position against a short circuit.

9. Breakers shall have a thermal bimetallic element for time delayed overload protection and a magnetic element for short circuit protection.

10. The breaker shall be trip indicating with the trip position midway between the "On" and "Off" positions.

11. Breakers for power distribution panels shall be F frame or larger. All breakers rated above 225 amps shall have interchangeable magnetic trip elements.

12. All breakers shall be UL listed, and conform to requirements of NEMA Standards.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Boxes for surface mounted panelboards shall be mounted so there is at least ½ inch air space between the box and the mounting surface.

B. Circuit directories shall be typed giving location and nature of load served.

C. Each panelboard shall be nameplated with plastic engraved nameplates stating the panel's name, voltage, and the name of panel serving the panel. Nameplates shall be secured by use of stainless steel screws.

END OF SECTION

SECTION 16460
TRANSFORMERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide transformers as indicated and as specified herein. Transformer locations and size shall be as shown on the Contract Drawings.

1.02 SUBMITTALS

A. Submit product data on all equipment. Provide a schedule describing the application of each transformer including item served, size and voltage of transformer.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Schneider/Square D, General Electric, Siemens, Eaton, or equal.

2.02 FABRICATION

A. General Purpose Dry-Type Transformers

1. Single phase transformers shall be 480 or 600 volt primary and 120/240 volt secondary. Three phase transformers shall be 480 or 600 volts delta primary and 208 Y/120 or 240 volt delta secondary. Transformers 25 KVA and larger shall have a minimum of 4 (2 above, 2 below) 2 ½ percent full capacity primary taps.

2. Transformers shall be 150 degrees Celsius temperature rise above a 40 degrees Celsius ambient. All insulating materials are to be in accordance with the latest NEMA Standards for a 220 degrees Celsius UL recognized insulation system.

3. Transformer coils shall be of the continuous wire wound construction and shall be impregnated with non-hygroscopic, thermo-setting varnish. The coils shall also have a final wrap of electrical insulating material to prevent mechanical injury to the wire as well as increasing the electrical breakdown strength.

4. All cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated from the base by means of rubber, vibration absorbing mounts. There shall be no metal-to-metal contact between the core and coil to the enclosure. On transformers 500 KVA and smaller, the vibration isolation system shall be designed to provide a permanent fastening of the core and coil to the enclosure. To further facilitate vibration and noise isolation, the final section of conduit to the transformer shall be flexible.

5. Transformers 25 KVA and larger shall be in heavy gauge, sheet steel, ventilated enclosures. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code Standards for ventilated enclosures. Transformers 25 KVA through 75 KVA shall be designed so they can either be floor or wall mounted.

6. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished in the same color as the motor control equipment. For more details see Division 9 of these Specifications.

7. The maximum temperature of the top of the enclosure shall not exceed 50 degrees Celsius rise above a 40 degrees Celsius ambient.

8. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with NEMA and NEC Standards.

9. The transformer shall be marked "DANGER HIGH VOLTAGE" with labels specified in the section on marking, this Division.

10. The transformers shall be manufactured to requirements of applicable standards, especially as they apply to noise level and surface temperatures.

11. The transformers efficiency shall be DOE 2016 compliant.

PART 3 - EXECUTION

3.01 INSTALLATION / APPLICATION / ERECTION

A. Transformers shall be rigidly mounted to the structure or the foundation in the case of freestanding units.

B. Transformers shall be megger tested prior to energization.

C. Transformers with taps shall be adjusted to supply the nominal service voltage required on the secondary.

D. Transformers shall be installed in accordance with NEC requirements and manufacturer recommendations.

E. Ground secondary of transformer per NEC requirements.

END OF SECTION

SECTION 16483
ADJUSTABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 SCOPE

A. Provide adjustable frequency drives (AFD) as specified herein and as shown on the Contract Drawings.

1.02 RELATED SECTIONS

A. Section 16010 General Electrical Requirements

B. Section 16440 Motor Control

1.03 REFERENCES

A. The adjustable frequency drives and all components shall be designed, manufactured and tested in accordance with the latest applicable standards including the following:

1. Underwriters Laboratories (UL508C: Power Conversion Equipment)
2. IEC 61800-3

1.04 SUBMITTALS

A. The following information shall be submitted to the Engineer for approval:

1. Dimensioned outline drawing
2. Schematic diagram
3. Power and control connection diagram(s)
4. Descriptive bulletins
5. Product sheets

B. O&M manuals are required in accordance with Section 16010 requirements. As-built wiring diagrams and as-built parameter settings list are required.

1.05 QUALIFICATIONS

A. The supplier of the assembly shall be the manufacturer of the electromechanical power components used within the assembly, such as bypass contactors when specified.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 certified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. A copy of these instructions shall be included with the equipment at time of shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Rockwell

B. Eaton

C. Schneider

D. ABB

E. Danfoss

F. Or equal.

2.02 ADJUSTABLE FREQUENCY DRIVES (AFD)

A. Adjustable frequency drives shall have the following features:

1. The AFD shall be rated for the voltage indicated on the Drawings. The AFD shall provide microprocessor-based control for three-phase induction motors. The AFD shall be rated for heavy duty service with the motor size indicated on the Drawings.
2. The AFD shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source AFDs are not acceptable. Insulated Gate Bipolar Transistors (IGBT's) shall be used in the inverter section. Bipolar Junction Transistors, GTO's or SCR's are not acceptable.
3. The AFD shall have efficiency at full load and speed of at least 97%.
4. The AFD shall maintain the line side displacement power factor at no less than 0.97, regardless of speed and load.
5. The AFD shall have a one (1) minute overload current rating of 150% and a three (3) second overload current rating of 180%.
6. The AFD shall be rated for at least the amount of short circuit current indicated on the Drawings, but in no case less than 35kA RMS symmetrical.
7. The AFD shall be capable of operating of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the AFD.
8. The AFD shall have an integral EMI/RFI filter.
9. A DC link choke is required. It shall be nominal 5% impedance with dual coils around the positive and negative DC bussing.
10. The AFD shall be able to start into a spinning motor. The AFD shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.
11. Standard operating conditions shall be:
    a. Incoming Power: As indicated voltage (+10% to -15%) and 50/60 Hz (+/-5 Hz)
    b. Frequency stability of +/-0.05% for 24 hours with voltage regulation of +/-1% of maximum rated output voltage.
    c. Speed regulation of +/- 0.5% of base speed.
    d. Load inertia dependant carryover (ride-through) during utility loss.
    e. Insensitive to input line rotation.
    f. Humidity: 0 to 95% (non-condensing and non-corrosive).
    g. Altitude: 0 to 3,300 feet (1000 meters) above sea level.
    h. Ambient Temperature: The AFD shall be rated for operation down to 0°C (32°F). If indicated to be mounted individually on a wall, the AFD shall be rated for a minimum of 40°C (104°F)

operation temperature. If indicated to be installed inside a control panel or MCC, the AFD shall be rated for a minimum of 50°C (122°F) operating ambient temperature.

12. Control Functions
    a. AFD programmable parameters shall be adjustable from a digital operator keypad. The AFD shall have a alphanumeric programmable display with status indicators. Keypads must use plain English words for parameters, status, and diagnostic messages. Keypads that are difficult to read or understand are not acceptable, and particularly those that use alphanumeric code and tables. Keypads shall have backlighting.
    b. The keypad shall include a Local/Remote pushbutton selection. Both start/ stop source and speed reference shall be independently programmable for Keypad, Remote I/O, or Field Bus.
    c. The frequency drive shall include an Ethernet port for programming, monitoring, and control. Ethernet/IP is the required protocol.
    d. The operator shall be able to scroll through the keypad menu to choose between the following:
        1. Monitor
        2. Operate
        3. Parameter setup
        4. Actual parameter values
        5. Active faults
        6. Fault history
        7. Information to indicate the standard software and optional features software loaded.
    e. The following setups and adjustments, at a minimum, are to be available:
        1. Start command from keypad, remote or communications port
        2. Speed command from keypad, remote or communications port
        3. Motor direction selection
        4. Maximum and minimum speed limits
        5. Acceleration and deceleration times, two settable ranges
        6. Critical (skip) frequency avoidance
        7. Torque limit
        8. Multiple attempt restart function
        9. Multiple preset speeds adjustment
        10. Catch a spinning motor start or normal start selection
        11. Programmable analog output
        12. DC brake current magnitude and time
        13. PID process controller
13. The AFD shall have the following system interfaces:
    a. Inputs – A minimum of four (4) programmable digital inputs, two (2) analog inputs and Ethernet/IP communications interface shall be provided with the following available as a minimum:
        1. Remote manual/auto
        2. Remote start/stop
        3. Remote forward/reverse
        4. Remote preset speeds
        5. Remote external trip
        6. Remote fault reset

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7. Process control speed reference interface, 4-20mA DC
8. Potentiometer and 1-10VDC speed reference interface
9. Ethernet programming and operation interface port

B. Outputs – A minimum of three (3) discrete programmable digital outputs and two (2) programmable analog outputs shall be provided, with the following available at minimum.

1. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:
   a. Fault
   b. Run
   c. Ready
   d. Reversed
   e. Jogging
   f. At speed
   g. Torque Limit Supervision
   h. Motor rotation direction opposite of commanded
   i. Over-temperature
2. Programmable analog output signal, selectable with the following available at minimum:
   a. Motor current
   b. Output frequency
   c. Frequency reference
   d. Motor speed
   e. Motor torque
   f. Motor power
   g. Motor voltage
   h. DC-bus voltage
   i. AI1 (Analog Input 1)
   j. AI2 (Analog Input 2)
   k. PT100 temperature
3. Monitoring and Displays
   a. The AFD display shall be a LCD type capable of displaying the following thirteen (13) status indicators:
      1. Run
      2. Forward
      3. Reverse
      4. Stop
      5. Ready
      6. Alarm
      7. Fault
      8. Input/Output (I/O) terminal
      9. Keypad
      10. Bus/Communication
      11. Local (LED)
      12. Remote (LED)

13. Fault (LED)

4. The AFD keypad shall be capable of displaying the following monitoring functions at a minimum:
   a. Output frequency
   b. Frequency reference
   c. Motor speed
   d. Motor current
   e. Motor torque
   f. Motor power
   g. Motor voltage
   h. DC-bus voltage
   i. Unit temperature
   j. Calculated motor temperature
   k. Voltage level of analog input
   l. Current level of analog input
   m. Digital inputs status
   n. Digital and relay outputs status
   o. Analog Input
5. Protective Functions
   a. The AFD shall include the following protective features at minimum:
      1. Over-current
      2. Over-voltage
      3. Inverter fault
      4. Under-voltage
      5. Input phase loss
      6. Output phase loss
      7. Under-temperature
      8. Over-temperature
      9. Motor stalled
      10. Motor over-temperature
      11. Motor under-load
      12. Logic voltage failure
      13. Microprocessor failure
   b. The AFD shall provide ground fault protection during power-up, starting, and running. AFD with no ground fault protection during running are not acceptable.
6. Diagnostic Features
   a. Fault History
      1. Record and log faults
      2. Indicate the most recent first, and store up to 30 faults
7. Enclosure
   a. The AFD enclosure shall be as indicated on the Drawings. The AFD shall have complete front accessibility with easily removable assemblies. Where installed inside a cabinet or MCC, the human interface module (HIM) shall be panel-mounted such that operator can access the HIM without opening the cabinet/MCC door.

8. The AFD manufacturer shall maintain, as part of a national network, engineering service facilities within 100 miles of project to provide start-up service, emergency service calls, repair work, service contracts, maintenance and training of customer personnel.

2.03 SPARE PARTS

A. The main logic board, keypad, power supply board, and I/O board shall be supplied as spares, one for each different part number supplied.

B. Alternatively, a full spare AFD may be supplied in lieu of the individual components specified above – one for each different part number supplied.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

1. All printed circuit boards shall be functionally tested via automatic test equipment prior to unit installation.
2. Each AFD shall be power-tested and hi-pot tested prior to assembly into its final enclosure/MCC.
3. After assembly into enclosure/MCC, provide functional tests at rated voltage.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.02 INSTALLATION

A. Install per manufacturer's instructions.

B. Configure parameters according to actual driven motor nameplate data.

C. Set the minimum and maximum speeds as directed by the motor manufacturer.

3.03 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's employed Field Service Engineer to assist the Contractor in installation and start-up of the equipment specified under this section. Field Service personnel shall be factory trained with periodic updates and have experience with the same model of AFD on the job site. Sales representatives will not be acceptable to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, installation as specified in manufacturer's installation instructions, wiring, application dependant adjustments, and verification of proper AFD operation.

B. The Contractor under the technical direction of the manufacturer's service representative shall perform the following minimum work.

1. Inspection and final adjustments.
2. Operational and functional checks of AFD and spare parts.
3. The Contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the AFD in accordance with those instructions.

C. The Contractor shall provide three (3) copies of the manufacturer's field start-up report.

3.04 MAINTENANCE / WARRANTY SERVICE

A. Warranty shall be a minimum of two years from the date of start-up and include all parts, labor, and travel time.

3.05 TRAINING

A. The Contractor shall provide a training session for up to 5 owner's representatives for ·one normal workday. Training and instruction time shall be in addition to that required for start-up service.

B. The manufacturer’s qualified representative shall conduct the training.

C. The training program shall consist of the following:

1. Instructions on the proper operation of the equipment.
2. Instructions on the proper maintenance of the equipment.

END OF SECTION

SECTION 16495
SWITCHBOARD MATTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Switchboard matting shall be furnished by the Contractor and placed in front of the motor control center, panelboard, and DCC-GAC equipment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Switchboard matting shall be W.H. Salisbury & Company, Safety Line, Inc., Tepromark, Wearwell, Erico, or equal.

2.02 MATERIALS

A. Switchboard matting shall be nonconductive with a minimum of 40,000 volts dielectric strength. The mat shall have a corrugated, non-slip surface and shall be a minimum of 1/4 inch thick. Width shall be 36 inches and length shall be as required at each location. The mat shall be black in color, ozone and oil resistant, and manufactured to meet all applicable ANSI/ASTM standards.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION

SECTION 16500
LIGHTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide light fixtures as indicated on the Drawings and as specified herein. The specific characteristics of the light fixtures to be furnished and installed shall be as detailed in the light fixture schedule on the Contract Drawings.

1.02 RELATED WORK

A. Related Sections: The following sections contain requirements that related to this section.

1. Division 1 – General Requirements

2. Section16010 – General Electrical Requirements

1.03 SUBMITTALS

A. General: Submit shop drawings in accordance with Section 16010 General Electrical Requirements and the General and Special Conditions. The lighting submittal shall be complete with all fixtures listed utilizing the same tagging convention as listed in the Light Fixture Schedule on the Drawings. The minimum data for each light fixture shall include complete photometrics, electrical characteristics, construction characteristics, and options clearly highlighted or circled.

B. Shop Drawings shall be clearly marked and or highlighted as to which product, type, option, etc. is being submitted. Product literature with one or more styles / configurations for a single product shall have a written description of use for each of the styles / configurations represented on the literature.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers are Holophane, Lithonia, Cooper, Hubbell, or equal.

2.02 BALLASTS

A. Electronic ballasts with less than 10% THD (Total Harmonic Distortion) shall be provided with luminaires.

B. All Luminaires shall be quiet. If a Luminaire develops a noticeable hum within the warranty period, the Luminaire shall be replaced without cost to the Owner.

2.03 LUMINAIRES

A. All fixtures shall be delivered complete with suspension and mounting accessories, ballasts, diffusers, reflectors, etc., all wired and assembled. All accessory wiring shall be furnished and installed as shown on the Contract Drawings.

B. All supports required for luminaires in addition to that furnished under the general building construction shall be furnished and installed by the Contractor. Provide stainless steel chain for chain-hung fixtures.

2.04 LAMPS

A. Color temperature shall be 4000k unless indicated otherwise on the Contract Drawings.

B. Minimum Color Rendering Index (CRI) shall be 80 unless otherwise indicated.

2.05 LIGHTING CONTACTORS

A. Contactor shall be NEMA ICS 2, electrically held contactor. Contacts shall be rated 600 volts, 30 amperes, and shall include minimum 4 poles. Coils shall be rated for 120vac. Provide in NEMA 1 enclosure conforming to NEMA ICS 6 unless otherwise indicated. Contactor shall have silver alloy double-break contacts. Provide contactor with hand-off-automatic selector switch. Contactor shall be Square D, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. General:

1. The Contractor shall furnish all light fixtures, lighting equipment, components, hangers, etc., as shown on the Contract Drawings and shall install them at the locations shown on the Contract Drawings.

2. Deliver lighting fixture in individually wrapped in factory containers. Stack and store in accordance with manufacturer's instructions.

3. All fixtures must be UL labeled and listed.

4. Lamps are required in all fixtures, whether indicated in the Schedule or not.

B. Luminaires:

1. All recessed fixtures shall be securely fastened per detail on the drawings.

2. Mounting heights specified as indicated shall be to bottom of fixture. Coordinate exact mounting of lighting fixture with type, style and pattern of ceiling being installed.

3. Any fixtures damaged prior to final completion shall be replaced by Contractor.

4. Replace lamps in lighting fixture which are observed to be inoperable or noticeably dimmed prior to final completion or within the warranty period.

5. All fixtures shall be left in a clean condition, free of dirt and defects, and shall be cleaned prior to final completion.

C. Light Poles:

1. A concrete foundation shall be provided for each pole as detailed on the Contract Drawing. The poles shall be mounted utilizing anchor bolts set in the concrete. The anchor bolts shall have galvanized or plated threads and shall be furnished with the pole by the manufacturer.

2. When anchor bolts are positioned prior to pouring concrete, spacing and projection must be

verified with pole manufacturer's recommendations. A plastic or plywood template should be fabricated from the manufacturer's instructions to use when setting the anchor bolts. Anchor bolts that are not installed plumb and in the correct locations shall be removed and replaced. The Contractor shall not be allowed to bend the anchor bolts back to plumb after concrete is set.

3. Leveling nuts shall be utilized for the mounting of poles to foundations. A nut should be screwed down on each bolt until it meets the concrete, then the nuts must be adjusted until they are level.

4. The pole shall be carefully lowered onto the anchor bolts and allowed to rest on the leveling nuts. Flat washers followed by lockwashers should be placed on the anchor bolts and the top nut installed. Minor adjustments on the leveling nuts may be necessary to plumb the pole before the top nuts are tightened down. Special care shall be taken to tighten the top nuts to the torque level recommended by the pole manufacturer. All nuts and washers shall be galvanized or plated.

5. Concrete grout of the nonshrink type must be installed between the base of the pole and the concrete foundation. The grout should be puddled around the edge of the pole base and firmly packed int he space between the pole and foundation. A short piece of small diameter pipe must be installed to make a drain hole through the grout to the pole interior.

6. Aluminum poles must have the bottom of the base painted with Koppers bitumastic No. 50 or equal substitute product before grouting so that the aluminum does not come in contact with the concrete.

7. Poles shall not be modified or drilled on the job site.

8. Under no circumstances should a ground wire be wrapped around an anchor bolt underneath an anchor bolt nut.

9. Do not set poles without light fixtures installed, as poles are more likely to vibrate and become damaged.

10. Manufacturer's installation instructions should be followed as well as those instructions contained herein. Should a discrepancy exist, promptly contact the Engineer for clarification.

11. Bases shall have 1" chamfer all around and rubbed and buffed smooth to below grade.

12. Anchor bolt covers shall also be provided and installed.

END OF SECTION

SECTION 16580
OCCUPANCY SENSORS

PART 1 – GENERAL

1.01 SUMMARY

A. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the "On" / "Off" function of the loads automatically.

B. The Contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

C. Product shall be warranted for 5 years.

PART 2 – PRODUCTS

2.01 MANUFACTURERS AND SUBSTITUTIONS

A. Manufacturers shall be Sensor Switch, GE, Leviton, Novitas, or equal.

B. Alternate Manufacturers shall be submitted no less than 5 days prior to bid date. All substitutions must provide technical literature. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to the exception.

C. Shop Drawings shall be clearly marked and or highlighted as to which product, type, option, etc. is being submitted. Product literature with one or more styles / configurations for a single product shall have a written description of use for each of the styles / configurations represented on the literature. For example: Device boxes – Styles shall be listed as: For masonry walls, for electrical devices, for ceiling mounted light fixtures, etc.

D. Active Ultrasonic sensing technology shall not be accepted.

E. Sensing technologies shall be completely passive in nature. The occupancy sensor system shall not emit or interfere with any electronic device, or human characteristic. Acceptable technology is PIR/Microphonic Passive Dual Technology.

F. Time Delay settings shall be factory set at 10 minutes, and shall not be adjusted unless specifically instructed. Maximum adjustment shall be 20 minutes. Automatic adjustments to this delay period by the sensor shall not be permitted.

G. All line voltage devices shall be UL Listed under Energy Management Equipment, or Industrial Control Equipment. UL Listing under Appliance Control shall not be accepted.

2.02 WALL SWITCH SENSORS – LARGE AREAS

A. Sensor shall surface mount to single gang switch box.

B. Sensor shall use PIR sensing incorporating a nominal one-inch focal length lens viewing 9 inches above and below horizontal view pattern measured at 20 feet.

C. Sensor shall have optional feature for photocell/daylight override.

D. In areas with inboard/outboard switching or two circuits, sensor shall provide two dedicated relays and override switches.

E. Sensor shall utilize dual technology PIR/Microphonic sensing.

F. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified.

1. LWS-PDT (PIR/Microphonic) , or equal.

2. LWS-PDT-2P (PIR/Microphonic inboard/outboard or two circuits), or equal.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. General:

1. The Contractor shall furnish all equipment, components, interconnecting wiring, hangers, etc., as shown on the Contract Drawings and shall install sensors at the locations shown on the Contract Drawings.

2. All occupancy sensor wiring shall be in conformance with the latest revision of the NEC and UL standards. All units shall be UL labeled and listed.

3. All conductors and wiring shall be provided per Manufacturer's recommendations in ¾" conduit.

4. Contractor, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay and Photocell field adjustments shall be provided as needed.

END OF SECTION

SECTION 16670
LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a lightning protection system for the new GAC building. The lightning protection system shall be furnished, installed, and connected as detailed on the Contract Drawings to provide a complete and functional system. Installation and equipment construction shall comply with Lightning Protection Institute Installation Code LPI-175, UL Master Label Code 96A, and NFPA 780.

B. The Contractor shall provide shop drawings indicating location and installation of equipment for review of the Engineer before beginning installation.

C. All equipment shall be of the same manufacturer, insofar as possible.

D. Equipment specified herein supplements actual suppression devices specified in Section 16280.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. “Thompson Lightning Protection, Inc.,” “Independent Protection Co., Inc.,” “National Lightning Protection, Inc.” or equal.

2.02 EQUIPMENT

A. All equipment used in this installation shall be UL approved and labeled in accordance with UL procedures, with each air terminal bearing an “A” label and all main conductors bearing a “B” label at 10'-0" intervals.

B. All equipment shall be new, and of design and construction to suit the application where it is used in accordance with accepted industry standards and LPI and UL code requirements and as per manufacturers recommendations.

C. Downlead conductors from roof to ground shall be copper, of 28 strands, 17 gauge minimum. All main roof conductors shall be aluminum, of 24 strands, 14 gauge minimum.

D. Air terminals shall be solid, round aluminum bar of ½” minimum diameter, and shall project 10" minimum above the object to be protected.

E. Air terminal bases shall be of cast aluminum with bolted pressure cable connections and shall be securely mounted with stainless steel screws or bolts. Bases on built-up tar and gravel roofs shall be secured with a proper adhesive and shall have a minimum surface contact area of 18.5 square inches.

F. Ground rods shall be a minimum of 3/4" in diameter and 10'-0" long. They shall be connected to the system using exothermic welds, Cadweld, or equal.

G. Cable fasteners shall be substantial in construction, electrolytically compatible with the conductor and mounting surface and shall be spaced according to LPI and UL code requirements.

H. Bonding devices, cable splicers and miscellaneous connectors shall be of cast aluminum with bolted pressure connections to cable. Cast or stamped crip fittings are not acceptable.

I. Equipment on stacks and chimneys shall be protected from corrosion and sized in accordance with LPI and UL requirements.

J. All miscellaneous bolts, nuts, and screws shall be stainless steel.

K. An approved bimetal transition fitting shall be used at the roof level to change from aluminum roof conductor to copper downlead cable.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. The installation shall be accomplished by an experienced installer listed with Underwriters' Laboratories as qualified and who is also a Certified Master Installer of the LPI or working under the direct supervision of an LPI manufacturer as listed above or his authorized LPI Certified Master Installer representative.

B. All equipment shall be installed in a neat workmanlike manner in the most inconspicuous manner possible. The system shall consist of a complete cable network on the roof including all air terminals, splices, and bonds with cable downleads routed concealed either directly in the building construction for a new structure or in conduit to ground for an existing structure.

C. The copper downlead cables shall not be brought directly through the roof. Through roof connectors with solid rods or conduits though pitch pockets shall be utilized for this purpose. This must be coordinated with the roof manufacturer.

D. The limitations on areas of usage for aluminum cables and for copper and aluminum materials together as outlined in UL 96A and LPI 175 shall be observed. The lightning protection installer will work with other trades to ensure a correct, neat, and unobtrusive installation.

E. It shall be the responsibility of the lightning protection installer to assure a sound bond to the metallic main water service and to assure interconnection with other building ground systems, including both telephone and electrical and also to ensure that proper arresters have been installed on the power service.

F. Downlead conductors from roof to ground shall be protected from mechanical damage from a point 8 feet above to 1 foot below grade by conduit or other means. Downlead conductors must be installed CONCEALED on all new construction. Surface-mounted conduits/raceways will only be allowed on existing facilities that are being upgraded with lightning protection systems.

G. The lightning protection installer shall secure and deliver a UL Master Label and LPI System Certification to the Engineer for the Owner upon completion of the installation.

H. The Contractor shall also submit 2 copies of as built shop drawings, 1 with the UL Master Label Application Form and another with LPI forms 175A and B.

I. A permanent plate shall be affixed to the protected structure in a prominent location, indicating its UL approval.

END OF SECTION

SECTION 16710
TELECOMMUNICATIONS CABLING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a building telecommunications cabling and pathway system which shall include permanently installed cabling, pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport data between equipment items.

B. Provide a new IDF cabinet for the GAC building, and other telecommunication equipment as indicated on the Drawings.

C. Provide telecommunications outlet assemblies where indicated on the Contract Drawings.

D. Provide grounding as specified herein and as indicated.

1.02 RELATED WORK

A. Drawings and General Provisions of this Contract including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work of this Section.

B. Section 16010 – General Electrical Requirements

C. Section 16130 - Raceways

D Section 16131 – Boxes

E. Section 17200 – SCADA Hardware

1.03 REFERENCES

A. The publications of the standards organizations listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the organization abbreviation with applicable publication number.

1. ASTM INTERNATIONAL (ASTM)

2. ELECTRONIC INDUSTRIES ALLIANCE (EIA)

3. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

4. INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

5. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

6. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

7. U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

8. UNDERWRITERS LABORATORIES (UL)

9. U.S. Dept. of Agriculture (USDA) – (RUS)

1.04 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2, EIA TIA/EIA-568-C.3, EIA TIA/EIA-569-A, EIA TIA/EIA-606-A and IEEE Std 100 and herein.

B. Pathway - A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.05 SUBMITTALS

A. The submittals listed below are required and shall be submitted in accordance with Section 16010. Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, industry, and technical society publication references.

B. Shop Drawings/Product Data (submit prior to procurement/installation)

1. Product data – Shall include telecommunications cabling, patch panels, telecommunications outlet/connector assemblies, connector blocks, equipment support frames, and all other equipment to be installed.

2. Manufacturer Test Reports – Shall include manufacturer’s factory reel test.

3. Certificates – Shall include Telecommunications Contractor qualifications, Key Personnel qualifications, and Manufacturer qualifications

4. Test plan - Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the UTP and optical fiber components and accessories. Include procedures for certification, validation, and testing.

C. Operation and Maintenance Manuals (submit when installation is substantially complete)

1. Include operation and maintenance information, including user manuals for all equipment.

2. Include all information in the shop drawing/product data submittal with updated as-built information and drawings.

3. Submit any required telecommunications management software on Compact Disk, along with a backup copy of any electronic databases or files developed during the course of the project.

D. Test Reports – Submit a binder with report of all testing required by Part 3 of this Section. Each cable shall have an individual test report signed and certified by the tester. This can be part of the O&M manual submittal.

1.06 QUALITY ASSURANCE

A. Work under this section shall be performed by and the equipment shall be provided by an approved telecommunications contractor and key personnel. Qualifications shall be provided for the telecommunications system contractor, the telecommunications system

installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

B. Telecommunications Contractor - The Contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The Contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the Contractor.

C. Key Personnel - Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Level 2 fiber is required. Submit documentation of current BICSI certification for each of the key personnel. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel.

D. Minimum Manufacturer Qualifications - Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2 and EIA TIA/EIA-568-C.3.

E. Regulatory Requirements - Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

F. Standard Products - Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer. Products manufactured more than 3 years prior to date of delivery to site shall not be used.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C (32 to 140 degrees F) and in the range of 0 to 95 percent relative humidity, noncondensing.

1.08 WARRANTY

A. The warranty shall comply with the General Conditions of this Contract.

1.09 SPARE PARTS

A. Furnish one spare switch for each unique switch installed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cabling and Accessories

1. Copper – “Belden,” “Alpha Wire,” “General Cable,” or equal.

2. Fiber – “Corning,” “Belden,” “Alpha Wire,” “General Cable,” or equal.

2.02 COMPONENTS

A. All components shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.03 TELECOMMUNICATIONS PATHWAY

A. Provide telecommunications pathways in accordance with EIA TIA/EIA-569-A and as specified herein.

B. Conduit and Surface Metal Raceways – See Section 16130 for requirements.

C. Open Telecommunications Cable Support – Will not be allowed on this project. Conduit is required for cabling.

2.04 TELECOMMUNICATIONS CABLING

A. Cabling shall be UL listed for the application and shall comply with EIA TIA/EIA-568 and NFPA 70. Provide a labeling system for cabling as required by EIA TIA/EIA-606-A and UL 969. Cabling manufactured more than 12 months prior to date of installation shall not be used.

B. Optical Fiber

1. Provide in accordance with ICEA S-83-596, EIA TIA/EIA-568-C.3, UL 1666 and NFPA 70. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 40 inches.

2. Fiber shall be EIA TIA/EIA-492AAAB, multimode type OM3, 50/125-um diameter, 0.275 numerical aperture, tight buffered fiber optic cable listed for wet location use in outdoor duct/conduit. Provide minimum 6 fibers in the cable. Provide nonconductive optical fiber general purpose cable (OFN or OFNG), nonconductive optical fiber plenum cable (OFNP), and nonconductive optical fiber riser cable (OFNR) rated cable in accordance with NFPA 70 and UL 910. Type OFNP or OFNR may be substituted for type OFN or OFNG and type OFNP may be substituted for type OFNR in accordance with NFPA 70. The cable cordage jacket, fiber, unit, and group color shall be in accordance with EIA TIA/EIA-598-B.

C. Horizontal Cabling - Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with EIA TIA/EIA-568-C.1.

1. Horizontal Copper - Provide horizontal copper cable in accordance with EIA TIA/EIA-568-C.2, UL 444, ICEA S-90-661 STP (overall shield twisted pair), 100 ohm, tested to 500Mhz minimum. Provide four each individually twisted pair, 24 AWG conductors, Category 6, with a blue thermoplastic jacket and overall shield. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 3 feet. The word "FEET" or the abbreviation "FT" shall appear after each length marking. Cable shall be 600V rated, industrial-grade Belden or equal.

2. Work Area Cabling & Patch Cables

    a. Work Area Copper - Provide pre-connectorized work area copper cable and patch cables in accordance with EIA TIA/EIA-568-C.2, with a blue thermoplastic jacket, compliant with same specifications as Horizontal Copper cabling above except patch cables in the IDF/MDF cabinet are NOT required to be shielded.

2.05 TELECOMMUNICATIONS SPACES

A. Provide connecting hardware and termination equipment to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with EIA TIA/EIA-606-A.

B. IDF-GAC Cabinet - Provide in accordance with EIA-310-D and UL 50:

1. Cabinet - wall-mounted modular type, 16 gauge steel or 11 gauge aluminum construction , minimum, treated to resist corrosion, double-hinged. Cabinet shall have have lockable front and rear door[s], louvered side panels, 250 CFM roof mounted fan, ground lug, and top and bottom cable access. Cabinet shall be compatible with 19 inch panel mounting. A door lock with keys shall be included. A rack-mounted uninterruptable power supply is required in the cabinet.

2. Video/security ethernet switch – Provide a Signamax SC30020 or equal, 24-port managed layer 2 POE+ switch with minimum (16) 10/100/1000 copper ports and (2) gigabit SFP ports. Provide the appropriate SFP modules and rack mounting hardware. POE capacity shall be 370W minimum. Warranty shall be 5 years minimum.

3. SCADA Ethernet switch – Shall be same specs as the video/security ethernet switch.

4. Rackmount UPS: Shall be APC or equal, line-interactive or online type, minimum 1500VA, hot swappable batteries

5. See patch panel and patch cable requirements below.

C. Existing WTP Bldg I.T. Rack - Provide in accordance with EIA-310-D and UL 50:

1. Provide new fiber patch panel per the requirements below.

2. Provide new video/security ethernet switch with same specs as above.

3. Provide all necessary patch cabling.

D. Security Gate Fiber Conversion Cabinet:

1. Cabinet – Provide a NEMA 4X SS316 cabinet. Include an industrial-grade 500VA UPS inside the cabinet – Sola or equal. An anti-condensation heater shall be included.

2. Video/security ethernet switch – Provide an industrial grade POE switch with minimum 4 ports and a fiber port with SFP module. Moxa or equal.

3. Provide a SPH (single panel housing) fiber patch panel.

4. Provide any necessary power supplies for camera or gate access control system.

E. Connector Blocks - Provide insulation displacement connector (IDC) Type 110 for Category 6 cabling termination. Provide blocks for the number of cables terminated on the block plus 25 percent spare.

F. Cable Guides - Provide cable guides, ring or bracket type, specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically in the cabinet.

G. Patch Panels - Provide ports for the number of cables terminated on the panel plus 25 percent spare. Provide pre-connectorized patch cords for patch panels. Provide patch cords, as complete assemblies, with matching connectors as specified. Provide fiber optic patch cables with crossover orientation in accordance with EIA TIA/EIA-568-C.3. Patch cords shall meet minimum performance requirements specified in EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2 and EIA TIA/EIA-568-C.3 for cables, cable length and hardware specified.

1. Modular to 110 Block Patch Panel - Provide in accordance with EIA TIA/EIA-568-C.1 and EIA TIA/EIA-568-C.2. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Panel shall be constructed of 0.09 inch minimum aluminum and shall be compatible with an EIA-310-D 19 inch equipment mounting. Panel shall provide 24 non-keyed, 8-pin modular ports, wired to T568B. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2. Fiber Optic Patch Panel - Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 16 gauge steel or 11 gauge aluminum minimum and shall be compatible with a EIA-310-D 19 inch equipment rack. Each panel shall provide 12 multimode type LC adapters. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray a minimum of 8 inches deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

2.06 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

A. Outlet/Connector Copper - Outlet/connectors shall comply with FCC Part 68EIA TIA/EIA-568-C.1, and EIA TIA/EIA-568-C.2. UTP outlet/connectors shall be UL 1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing, third party verified, and shall comply with EIA TIA/EIA-568-C.2 Category 6 requirements. Outlet/connectors provided for cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector,

color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired T568B. Outlet/connectors shall comply with EIA TIA/EIA-568-C.2 for 200 mating cycles.

B. Cover Plates - Telecommunications cover plates shall comply with UL 514C, and EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2, EIA TIA/EIA-568-C.3; flush design constructed of stainless steel to match receptacle/switch cover plates specified in Section 16140. Provide labeling in accordance with the paragraph LABELING in this section.

2.07 GROUNDING AND BONDING PRODUCTS

A. Provide in accordance with UL 467, TIA J-STD-607-A, and NFPA 70. Components shall be identified as required by EIA TIA/EIA-606-A

2.08 FIELD FABRICATED NAMEPLATES

A. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 1 by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.09 TESTS, INSPECTIONS, AND VERIFICATIONS

A. Factory Reel Tests - Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.3, and EIA TIA/EIA-526-14A for multimode optical fiber cables.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install telecommunications cabling and pathway systems, including the cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2, EIA TIA/EIA-568-C.3, EIA TIA/EIA-569-A, NFPA 70, and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified in Sections 16130 and 16131. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling. Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment. All cable should be installed in a neat and workmanlike manner.

B. Cabling – Install copper and optical fiber telecommunications cabling system as detailed in EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2, EIA TIA/EIA-568-C.3. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist cables more than 1/2 inch from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 10 feet in the telecommunications room, and 12 inches in the work area outlet. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use

only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For copper cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

C. Pathway Installations - Provide in accordance with EIA TIA/EIA-569-A and NFPA 70. Provide building pathways as specified herein and in Section 16130. All cabling shall be installed in conduit.

D. Work Area Outlets

1. Terminations - Terminate cable in accordance with EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2 and wiring configuration as specified.

2. Cover Plates - As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3. Cables - cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

4. Pull Cords - Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

F. Telecommunications Space Termination - Install termination hardware required for Category 6 and optical fiber system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

1. Connector Blocks - Connector blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with EIA TIA/EIA-569-A.

2. Patch Panels - Patch panels shall be mounted with sufficient ports to accommodate the installed cable plant plus 25 percent spares.

a. Copper Patch Panel - Copper cable entering a patch panel shall be secured to the panel with cable ties or as recommended by the manufacturer to prevent movement of the cable.

b. Fiber Optic Patch Panel - Fiber optic cable loop shall be 3 feet in length. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3. Equipment Support Frames - Install in accordance with EIA TIA/EIA-569-A:

a. The Contractor shall provide a 20 ampere duplex receptacle in the cabinet/rack and connect to a receptacle circuit.

G. Electrical Penetrations - Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 16010.

H. Grounding and Bonding - Provide in accordance with TIA J-STD-607-A and NFPA 70. Provide

a #6 AWG insulated isolated ground conductor from the ground loop to the IDF cabinet where terminal equipment is to be located.

3.02 LABELING

A. Labels - Provide labeling in accordance with EIA TIA/EIA-606-A. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process (such as a Brady labeler) or a laser printer.

B. Cables shall be labeled using color labels on both ends with identifiers in accordance with EIA TIA/EIA-606-A.

C. Termination Hardware - Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with EIA TIA/EIA-606-A.

3.03 FIELD FABRICATED NAMEPLATE MOUNTING

A. Fasten nameplates to the device with a minimum of two stainless steel machine screws or rivets.

3.04 TESTING

A. Telecommunications Cabling Testing - Perform telecommunications cabling inspection, verification, and performance tests in accordance with EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2, and EIA TIA/EIA-568-C.3 where applicable. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

1. Inspection - Visually inspect copper and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568B pin assignments, and inspect cabling connections to confirm compliance with EIA TIA/EIA-568-C.1, EIA TIA/EIA-568-C.2, and EIA TIA/EIA-568-C.3. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.

2. Verification Tests - copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connected. For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with EIA TIA/EIA-568-C.3 and EIA TIA/EIA-526-14A using Method A, Optical Power Meter and Light Source for multimode optical fiber. Perform verification acceptance tests.

3. Performance Tests - Perform testing for each cable as follows:

a. Perform Category 6 link tests in accordance with EIA TIA/EIA-568-C.1 and EIA TIA/EIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

b. Optical fiber Links. Perform optical fiber end-to-end Tier 1 link tests in accordance with EIA TIA/EIA-568-C.3. Also provide OTDR testing.

-- End of Section --

SECTION 16741
SECURITY GATE ACCESS & INTERCOMMUNICATION SYSTEM

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. Provide an access & intercommunication system with facial recognition as specified herein and as indicated on the Drawings. System shall provide 2-way audio between gate station and master stations via a call button. The master stations shall be able to open/close the gate. System shall also provide one-way video from the remote stations to the master stations. Facial recognition biometrics are required.

B. LB Surveillance & Security, LLC (Lee Bryant, 502-930-2010) is the required security integrator.

1.02 SUBMITTALS

A. Submit complete product data and shop drawings.

B. Submit system block diagram and complete wiring diagrams

C. Submit O&M manuals in accordance with 16010. Test reports required below shall be included in the O&M, along with an as-built configuration record of the system.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect all equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.04 SPARE PARTS

A. Provide five (5) spare fuses of each unique fuse type utilized.

B. Provide one (1) spare master intercom station and (1) spare gate station.

PART 2 PRODUCTS

2.01 INTERCOM EQUIPMENT

A. Video Capability: Provide intercom stations with video in addition to audio. Master stations must be able to view individuals at remote stations equipped with video, but remote stations must not be able to view video from the master station(s).

B. Video Master Stations must have the following features:

1. Shall be Akuvox IT88A or equal.

2. Color touch screen with a diagonal size of at least 10 inches.

3. Shall include built-in 1MP cmos camera and SIP communications.

4. Shall support two-way audio communication with other units in the network.

5. Shall include Wifi and Bluetooth

6. Shall include a built-in smart voice assistant.

C. Remote Audio-Video Gate Station

1. Shall be Akuvox X915S or equal.

2. Remote station shall be flush-mounted in the pedestal box.

3. Shall support SIP with facial recognition and include an 8” capacitive touch screen with minimum 1280x800 resolution and onboard speakers. Minimum 5 megapixel camera is required.

4. Call Switch that permits a call to the master station.

5. Weatherproof IP-66 rating

6. Shall support POE power supply

2.02 CABLING/WIRING

A. Type of signal and control circuit wire and number of conductors must be provided as recommended by the intercommunication system manufacturer, and as necessary to provide a complete and operable system.in accordance with NFPA 70.

B. Multi-conductor cables must contain only stranded conductors of minimum 18 AWG gauge, insulated with minimum 105-degree Celsius-rated insulation. Cable jacket must be rated at minimum of 105 degrees Celsius and the cable shall be listed for wet-locations.

C. Balanced twisted-pair telecommunications cables shall be minimum 24 AWG, Category 6, and listed for use in wet-locations along with installation in underground ducts/conduits.

D. Fiber optic cabling shall be 6-fiber, multimode, 50 micron, OM3, listed for wet locations in underground ducts/conduits. Refer to Section 16710.

2.03 FIBER CONVERTER CABINETS

A. See Section 16710 for requirements.

2.04 GATE ENTRANCE PEDESTAL

A. Provide a Pedestal Pro or equal gooseneck 48” pedestal suitable for pad-mounting.

B. Provide a 12” diameter by 24” deep concrete foundation for the pedestal, and utilize stainless steel anchors.

C. Provide a Pedestal Pro or equal housing for the gooseneck pedestal with dimensions sized for the intercom keypad. The housing shall have a sun-shroud.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all system components and appurtenances in accordance with the manufacturer's

instructions and as specified and shown. Units to be mounted outside or subject to inclement conditions must be weatherproof or be mounted in weatherproof enclosures.

3.02 WIRING AND CABLING

A. Install signal and control circuits in accordance with NFPA 70, TIA-568.0, TIA-568.1, TIA-568.2, TIA-568.3, and as indicated. The conductors must be separated as recommended by the equipment manufacturer.

B. Size conductors to maintain voltage drop in power circuits to no more than 3-percent and loss in signal circuits to no more than 0.5 dB. Include boosters, additional power supplies, amplifiers, switches, etc. as necessary to maintain these requirements.

C. All cabling shall be installed in conduit as specified in 16020.

D. Cables that do not use modular connectors can use terminal strips and junction boxes to extend the cable if in conformity with manufacturer recommendations.

3.03 PROGRAMMING

A. Provide programming of intercom system and access control to meet Owner requirements with individual access code for each operator which will open the security gate. Also provide individual access facial recognition credentials for up to ten (10) contractors/suppliers who will be given access to the plant at the discretion of the Owner.

3.04 TRAINING

A. Conduct a training course for members of the operating staff. The training course must be given at the site during normal working hours, and must start after the system is functionally complete and subsequent to successful final acceptance tests.

3.05 ACCEPTANCE TESTS

A. After installation has been completed, conduct an testing to demonstrate that the equipment operates in accordance with specification requirements as follows.

B. Cable Tests – provide Fluke (or equal) Certifier tests for all copper Cat-6 cabling. Provide Fluke (or equal) OTDR certifier tests for all fibers, including spares. Submit test reports under Section 16710 requirements.

C. Operational Test: Test originating station-to-station, and all call at each intercommunication station. Verify proper routing and volume levels and that the system is free of noise and distortion. Test available message path from each station on system. Test for proper video displays and automatic display of pre-preprogrammed video views. Verify that video from all remote stations appears at all master stations with proper resolution, focus, and color balance meeting the manufacturer's published specifications.

D. Test Reports: Submit test reports with O&M manuals, upon completion and testing of the installed system, showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria. Include in each test report the final position of controls and operating mode of the system. Include the manufacturer, model number, and serial number of test equipment used in each test.

End of Section

SECTION 16745

VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide video surveillance system (VSS) equipment, software, and commissioning as described herein and as shown on the Contract Drawings. LB Surveillance & Security, LLC (Lee Bryant, 502-930-2010) is the required security integrator.

B. The Contractor shall provide raceways and cabling required for the VSS as specified herein.

C. The video surveillance server specified herein shall replace the existing Hikvision NVR. Existing cameras shall be reused.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ELECTRONIC INDUSTRIES ALLIANCE (EIA)

2. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

3. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

4. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

5. UNDERWRITERS LABORATORIES (UL)

B. Section 16710 – Telecommunications Cabling System

C. Section 16741 – Security Gate Video Intercommunication System

1.03 SYSTEM DESCRIPTION

A. General - The Contractor shall install the equipment as described herein and as shown on the Contract Drawings. The equipment shall include all cabling, connectors, adapters, and terminators necessary to interconnect all equipment. Software license shall be turned over to Owner.

B. Cabling - See Section 16710 for requirements. Each camera will require an Ethernet cable which will transmit both data and power to/from the camera.

C. Environmental Conditions

1. Field Equipment - The cameras and all other field equipment shall be rated for continuous operation under ambient environmental conditions of minus 40.0 degrees F to 140 degrees F. Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, wind loading, ice loading, and vibration conditions specified or encountered for the installed location.

D. Electrical Requirements - Equipment shall be able to tolerate variations in the voltage source of plus or minus 10 percent, and variations in the line frequency of plus or minus 2 percent with no degradation of performance.

1.04 SUBMITTALS

A. All items of computer software and technical data (including technical data which relates to computer software), which are specifically identified in this specification shall be delivered strictly in accordance with Division 1 submittal requirements. All data delivered shall be identified by reference to the particular specification paragraph against which it is furnished.

B. Product Data and Shop Drawings (submit prior to procurement/installation)

1. Manufacturers' Data - The data package shall include manufacturers' data for all materials and equipment and software licenses provided under this specification. Selected options shall be clearly indicated, and non-applicable equipment shall be clearly marked out.

2. Shop Drawings – Show network architecture, IP addresses, etc.

C. Operation and Maintenance (O&M) Manuals – Submit a copy of the approved submittal data along with the manufacturer's user manuals for the cameras and the end user manual for the software license.

1.05 COMMISSIONING

A. Provide onsite commissioning and submit a written commissioning report.

1.06 TRAINING

A. Training shall be provided. Minimum one-half day.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Axis, Bosch, Honeywell or equal NDAA-compliant camera hardware

B. Salient, Exacq, Milestone, or equal NDAA-compliant video management software.

2.02 EXTERIOR CAMERA

A. Axis P5655-E PTZ or equal camera rated -40 to 140°F with NEMA-4X rating. POE with day/night functionality with infrared cut filter, 1080P resolution at 60 images per second (configurable), H.264 & H.265 compression, varifocal F1.4-4.0 progressive scan CMOS lens, wide dynamic range, IP with IP security and standard IP protocols, 32x optical zoom, 12x digital zoom, with preset positions and guard tour and with color picture down to 0. 1 lux and black/white picture down to 0.01 lux. Motion detection and email functionality is required. Analytical applications shall be included. Provide wall-mount bracket.

2.03 INTERIOR CAMERAS

A. Axis P1487-LE bullet camera or equal rated -40 to 140°F with waterproof rating. POE with day/night functionality with infrared cut filter, 5MP resolution at 30 images per second (configurable), H.264 & H.265 compression, varifocal F1.36-2.58 P-Iris IR corrected lens, , IP with IP security and standard IP protocols, digital zoom, color picture down to 0.09 lux and black/white picture down to 0.02 lux. Motion detection and email functionality is required. Analytical applications shall be included. Shall include built-in infrared illumination with range of 164 ft.

2.04 VIDEO SERVER & MONITOR

A. Provide a video server with the following specifications:

1. Rack-mount form factor
2. Intel Xeon 6 6369P or better
3. 64GB RAM
4. OS Harddrive: 2x 480GB M.2 SATA SSD with RAID 1
5. Video Harddrive: 6TB SSD video harddrive
6. Gigabit Ethernet NICs, minimum of two
7. Integrated graphics adapter
8. Windows Server 2025 version
9. 5-year warranty

B. Provide minimum 32” monitor with adjustable mounting stand, HP or equal. This monitor shall be mounted in the Control Room.

2.05 VIDEO SOFTWARE

A. Provide video management software licensed for (32) cameras. The software shall be shall include 3 years of software maintenance. Provide all configuration and commissioning.

2.06 WIRE AND CABLE

A. Provide per Section 16710.

2.07 MISCELLANEOUS

A. See Section 16710 for additional video surveillance equipment to be installed in I.T. racks.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall install all system components in accordance with the manufacturer's instructions, IEEE C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system. Raceways shall be furnished and installed as specified in Section 16130 RACEWAYS. Cabling shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring. All other electrical work shall be as specified in the

above sections including grounding to preclude ground loops, noise, and surges from adversely affecting system operation.

B. Enclosure Penetrations - All enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

C. Cold Galvanizing - All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

D. Cameras - The Contractor shall install the cameras as recommended by the manufacturer; connect Ethernet cable to the camera; aim camera to give field of view as needed to cover the alarm zone; and focus the lens to give a sharp picture over the entire field of view.

END OF SECTION

SECTION 16900

CONTROLS AND CONTROL PANELS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Equipment controls and control panels shall be as specified herein and as shown on the Contract Drawings.

1.02 RELATED WORK

A. Drawings and General and Supplementary Conditions of the Contract and Division 1 Specifications sections apply to this Section.

B. All motor controls, starters, pushbuttons, pilot lights, and other miscellaneous devices shall comply with Section 16440 – MOTOR CONTROL.

1.03 SUBMITTALS

A. Panel and enclosure plan and elevation drawings depicting all components and wiring duct

B. Complete wiring diagrams

C. Catalog cut-sheets on all components, with options clearly indicated and non-applicable items clearly excluded

D. Enclosure heat gain calculation – Shall indicate the maximum temperature inside the enclosure on a 100°F day taking into account heat losses and inefficiencies of all panel components. Heat gain shall include the effects of radiation (if located outside) and air-conditioners or ventilation fans. The maximum operating temperature of all major equipment and panel components shall be listed. The heat transfer calculation shall be based on the enclosure manufacturer's published heat transfer data. This manufacturer's data or curve shall be submitted with the calculation for review.

E. Shop Drawings shall be clearly marked and or highlighted as to which product, type, option, etc. is being submitted. Product literature with one or more styles / configurations for a single product shall have a written description of use for each of the styles / configurations represented on the literature.

F. O&M manuals shall be submitted in accordance with Section 16010. They shall include all field modifications made such that the wiring diagrams exactly match the field-installed equipment and control panels. They shall also include complete cut-sheets, product data, operation, and maintenance information.

1.04 REFERENCES

A. NFPA 79 – All control panels shall comply with NFPA 79.

B. NEC – All control panels shall comply with NEC article 409.

C. UL508 – All control panels shall be listed to UL508 and shall bear the UL label.

1.05 GENERAL REQUIREMENTS

A. All control panels furnished under this Contract shall be manufactured in accordance with industry

standards and as herein specified. The Contractor shall coordinate all subcontractors and vendors to ensure that the control panels are furnished and meet the requirements specified herein.

B. Control panels shall be as manufactured by Quality Controls, ADGO, Primex or other UL or ETL qualified panel vendor. Panel construction shall comply with OSHA requirements and shall be either UL or ETL listed.

C. Control panels to be furnished on this project shall be wired to function according to schematics shown on the Contract Drawings. In addition to the requirements shown on the Contract Drawings, the panels shall adhere to additional requirements as written herein, and in the utilization equipment specifications.

D. All components shall be mounted with threaded screws to a subpanel inside the enclosure such that they are replaceable without removing the subpanel. All wiring must be stranded and protected by a circuit breaker. Supplementary circuit breakers may be utilized for circuits that require wiring smaller than 14 gauge. Wiring ducts for cable/conductor management are required to be utilized for routing of conductors and cables. Ducts are also required to be provided for field-wiring at the top and bottom of the panels. All field wires should terminate at a terminal strip upon entering the control panel enclosure.

E. Elementary control schematics and connection diagrams showing the spatial relationship of components and wiring shall be submitted for review. Also, a bill of materials, drawing of device arrangement on front, and enclosure fabrication drawings shall be submitted. Further, descriptive literature is required on all components. A copy of the as-built wiring diagrams and BOM shall be stored in a pocket inside the control panel enclosure.

F. Labels shall be installed on all wires, keynoted back to the elementary schematic or the connection diagram, and all terminals identified.

G. Short circuit ampacity: The minimum short circuit ampacity of the control panel shall be as follows:

1. 480V control panels: 35kA

2. 208/240V control panels: 10kA

3. 120V control panels: 10kA

H. Controlled equipment shall restart automatically after a power outage is restored, unless specifically exempted by Engineer due to safety concerns.

PART 2 - PRODUCTS

2.01 ENCLOSURES

A. Control panel enclosure shall be wall-mount type where sized at 30” width x 42” height or less. Otherwise, it shall be floor-mount type. All panels indicated on the Drawings to be floor-mounted shall be floor-mounted regardless of size. Enclosures shall be single or double-door as required. Enclosure shall include a NEMA flange-mounted lockable disconnect for three-phase power supply, or an IEC style rotary lockable disconnect for single phase power supply. Enclosures shall be manufactured by Hoffman, or equal.

B. Enclosure NEMA rating shall be as indicated for the area on the Drawings. Enclosures to be located outside shall be NEMA 4X. NEMA 1/12/4 enclosures shall be steel with ANSI 61 gray finish unless painting is required in Division 9. NEMA 4X enclosure material shall be stainless steel type 316. The enclosure shall be sized to provide 10% spare panel space. Seams shall be continuously welded and

ground smooth.

C. Enclosure door shall have a 3-point latch. Screw clamps are not acceptable. The latch handle shall have a padlock hasp.

D. Enclosures to be installed outside shall have an interior dead-front swing out panel for panel-mounting of all pilot devices and displays. Operator devices shall not be mounted on the exterior of the enclosure, except for a single alarm strobe where indicated on the Drawings. The enclosure shall also have an interior pocket for holding wiring diagrams, and an interior sub-panel for mounting control equipment.

D. The enclosure door or doors shall be equipped with a door stop kit to secure the door in the open position during maintenance.

2.02 WIRING REQUIREMENTS

A. Wire and cable shall comply with Section 16120 except Type MTW conductors shall be used inside the control panel for control circuits. Control circuit wiring shall be 18 gauge or larger.

B. Control wiring shall be terminated using crimp-type ferrule, fork, or ring terminals. Power wiring shall utilize compression lugs.

C. Wiring shall extend to terminal blocks for connection to external equipment.

2.03 TEMPERATURE CONTROL DEVICES

A. Electric Heater for Control Panels

1. Provide an electric heater for exterior control panels
2. Heater shall be sized as indicated on the Contract Drawings, or shall be sized and submitted in the Enclosure Heat Gain calculation
3. The heater shall include an integral thermostat, adjustable from 0°F to 100°F, and a fan
4. Heater housing shall be anodized aluminum
5. Fan shall have ball bearings and shall be designed for continuous operation
6. Terminal strip shall accept both solid and stranded wire
7. The heater shall be UL Recognized and CSA listed
8. The heater shall be Hoffman's thermostatically controlled fan-driven heater, or equal.

2.04 MOTOR CONTROLS

A. Starters

1. All magnetic starters and contactors shall be steel mounted, front wired with all terminals accessible for wiring directly from the front. Movable contact blocks shall depend on gravity only and not the use of springs for operation to the open position.

2. Starters shall be NEMA type and sized appropriately for the motor to be controlled, but in no case shall any starter or contactor be smaller than NEMA size 1 or smaller than as indicated on the Drawings. IEC starters are not acceptable.

3. All contactors shall be double break, solid silver cadmium oxide alloy, or equal. Bare copper or silver flashed copper contacts which require periodic filing or cleaning maintenance will not be permitted.

4. Operating coils shall be pressure molded and so designed that, if accidentally connected to excessive voltage they will not expand, bubble or melt. When a coil fails under and condition,

the starter shall open and shall not "freeze" in the closed (on) position. Coils shall be replaceable from the front of the starter without having to remove the starter from the panel or enclosure.

5. Combination starters shall be of the molded case circuit breaker type. Trip elements of multi-pole breakers shall be effectively insulated from one another. Multi-pole breakers shall be designed such that an overload on one pole opens all poles simultaneously. Breakers shall be quick-make, quick-break and shall be entirely trip free to prevent the contacts being held in a closed position against a short circuit. Breakers for full voltage starters shall be the magnetic only type. All others shall be thermal magnetic.

6. Each starter leg shall have a thermal overload device in each ungrounded leg. The overload shall be solid-state, ambient compensated, adjustable type.

B. Variable Frequency Drives – See Section 16483

2.05 POWER SUPPLIES

A. DC Power Supplies

1. DC power supplies shall be switched mode and Din-rail mountable.
2. Input power range shall be from 85-264 VAC.
3. Output voltage range shall be as needed with a tolerance of 1%. Output voltage shall be adjustable up and down at least 10% from the nominal value.
4. The power supply shall include an internal input fuse.
5. Power supply shall have a “DC Ok” signaling LED.
6. Operating temperature rating shall be –25 C to +70 C and up to 95% relative humidity.
7. Output power shall be buffered for full output power ridethrough for 20 milliseconds in the event of a power outage.
8. The power supply shall be able to supply 150% of its continuous capacity for short periods of time.
9. The power supply shall have internal short circuit protection with automatic recovery.
10. The power supply shall be Phoenix Contact, Sola, Allen-Bradley, or equal.

2.06 OVERCURRENT PROTECTION

A. Main 3-Phase Breakers – Shall be thermal-magnetic, molded-case, Type FA or KA as needed, Square D or equal. Provide service entrance rating where indicated on the Drawings as being used in a service entrance application. See short circuit rating requirements above. Provide cable assembly to connect to flange-mounted disconnect.

B. Main Single-Phase Breakers – Shall be Din-rail mountable with clear “on,” “off,” and “tripped” positions, Square D QOU or equal. Where a substantial number of breakers are used, provide a panelboard mounting base.

C. Combination Starters – Circuit breakers for use with combination starters shall be magnetic-only, Square D PowerPacT MCP, or equal, with adjustable trip settings.

D. Supplementary Protectors – Shall be Din-rail mountable UL489 listed. Trip rating shall match load served.

E. Power Fuses – Utilize Class J fuses and fuse blocks. Fuse blocks must have protective cover. Fuses may only be used where indicated on the Drawings. Otherwise, use circuit breakers.

2.07 MISCELLANEOUS PANEL COMPONENTS

A. Terminal Blocks, #10 conductor size and smaller.

1. Terminal blocks shall be Din-rail mountable IEC style with minimum width of 6.2 mm. They shall be rated for conductors from #10 to #24 AWG. Current rating shall be 30A, minimum. Terminal blocks shall be finger-safe. Double level terminal blocks may be utilized where necessary to conserve space.
2. Screw clamp terminal blocks are required. Terminal blocks that rely upon spring pressure only for conductor termination are not acceptable.
3. Provide cross connection bridges, partition plates, end anchors, zack strip labels, and all other components necessary for a complete installation. Each block shall be labeled with a machine-printed label. No more than 2 conductors may be landed under on single terminal block terminal screw.
4. Utilize the following terminal block colors:
    a. 120V Power – Black
    b. 120V Control – Red
    c. 120V Neutral – White
    d. Equipment Grounding – Green or Green/Yellow
    e. DC Positive – Blue
    f. DC Negative/Grounded – Gray
    g. Conductor energized from remote source: Yellow
5. Terminal blocks shall be manufactured by Phoenix Contact, Allen-Bradley, or equal.

B. Fuse blocks (control circuits) – Fuse blocks shall be finger safe and shall have LED indication when the fuse is blown. Fuses may be used only where indicated on the Drawings; otherwise use circuit breakers.

C. Conductor Labels – Shall be the heat-shrink type, machine printed. Brady, or equal.

D. Component nameplates – Shall be engraved, rigid, laminated plastic with adhesive back and letter height of 3/16" minimum. Nameplates shall be white with black letters.

E. Transient/Surge protectors shall comply with Section 16280.

F. Control transformers shall be machine tool type transformers with epoxy encapsulated coils or resin impregnated coils, high quality silicon steel laminations, copper magnet wire, molded-in terminals, and 55°C rise insulation system.

G. Voltage/Phase Monitor – Shall continually measure the voltage of all phases of incoming power and provide protection for any motors or other equipment that could be damaged. The phase monitor shall sense under and overvoltage, voltage unbalance, phase loss, and phase reversal. It shall have a relay output.

H. Pilot Devices

1. Selector switches shall be NEMA 4X, 30mm, oil-tight construction, and of the quick-make, quick-break type.

2. Pushbuttons shall be NEMA 4X oil-tight, 30mm.

3. Pilot lights shall be 30mm, oil-tight, push-to-test, NEMA 4X LED type. Green pilot lights shall be used for indicating "pump running," and yellow shall be used for "seal leak."

4. Elapsed time meters shall be non-resettable.

5. Timing relays shall have an adjustable time range suitable for the application, with the time delay occurring after energization.

I. Control Relays

1. Control relays shall be magnetic, general purpose, "ice cube" type with 3-pole (minimum), double throw contacts rated at 5 amperes (minimum), 120 volts (minimum). Coils shall be rated to operate at the indicated control voltage.

2. Provide proper bases, mounting track, etc. for a complete installation. All relays shall be have a retainer clip, manual operator, and pilot light. Coils connected to solid-state digital outputs shall have transient surge protection.

J. PLC I/O Interposing Relays

1. Interposing relays shall be Allen-Bradley 700-HL series or equal with 6A single-pole double-throw contact, LED indicator, and built-in transient protection.

PART 3 - EXECUTION

3.01 LABELING

A. Provide labels for all conductors and components.

B. Legends for starter nameplates shall be taken from the one line diagram in the Contract Drawings. Wire and miscellaneous component labels shall match the O&M manual wiring diagrams.

3.02 GROUNDING

A. Enclosures shall be grounded in accordance with the NEC.

B. Each analog signal loop shall be grounded at a single point for the loop at the location of the DC power supply for the loop.

3.03 PROTECTION

A. All electrical and electronic components of the Control Panel shall be protected against damage due to electrical transients induced in interconnecting lines from lightning discharges and surges in nearby electrical systems. Provide a surge protection device (SPD).

B. All three-phase control panels with FVNR starters shall be equipped with a voltage/phase monitor. Panels with drives or soft-starters that have electronic fault protection against supply voltage problems are not required to have phase monitors.

3.04 INSTALLATION/ERECTION

A. Equipment furnished under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, manufacturer Shop Drawings, and manufacturer installation instructions.

END OF SECTION

SECTION 17010
GENERAL INSTRUMENTATION AND SCADA REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install all materials, services, spare parts, commissioning, and other services as shown and specified and as required to integrate the new equipment into the existing instrumentation and supervisory control and data acquisition (SCADA) system as indicated on the Drawings and as described herein. ECS Solutions (Jeff Morris, 270-256-1327) is the required systems integrator.

B. All Instrumentation/SCADA equipment shall be installed, connected, and left in operating condition. The number and size of cables and conductors between all equipment and SCADA monitoring/control devices shall be as required to obtain the operation described in these Specifications, and/or by the Contract Drawings, and/or as shown in manufacturer-furnished, Engineer-reviewed Shop Drawings. The Contractor shall be responsible for supplying all components such as relays, loop isolators, transducers, etc., as necessary, whether indicated or not, at no additional cost to the Owner in order to leave a complete functional instrumentation system. The Contractor shall ensure compatibility between all system components and provide any necessary peripheral equipment as required to make the components compatible.

C. The Contractor shall be responsible for making any modifications to existing equipment, where required to accept new equipment and systems. If modifications are to be made to equipment that is still under warranty of a manufacturer that the Contractor is not authorized to perform service to, then the Contractor shall obtain the services of that equipment manufacturer's service personnel to perform the work under the supervision of the Contractor.

D. Bidders are required to visit the construction site prior to submitting a bid and carefully examine the Contract Drawings and Specifications so that he/she may fully understand what is to be done and to document existing conditions. Any discrepancies, questions, or omissions must be brought to the attention of the Engineer at least 10 days prior to the bid opening date. Extras will not be approved for work that the Contractor should have seen beforehand by visiting the site prior to bidding.

1.02 RELATED WORK

A. Contractors bidding work under this Contract shall read and understand Division Zero and Division 1 - General Requirements. If any discrepancies are discovered between the General Instrumentation and Supervisory Control and Data Acquisition (SCADA) Requirements and General Requirements, the above-mentioned documents shall overrule this section. The General Instrumentation/SCADA Requirements are intended as a supplement to the above-mentioned documents. The Contractor shall bid as outlined in the above-mentioned Specifications and shall be governed by any alternates or unit prices called for in the form of proposal.

B. Division 16 - Electrical

1.03 SUBMITTALS

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted in the amount of copies as listed in the General Conditions, but no less than 8 copies. All Shop Drawings shall be submitted in loose-leaf three-ring cardboard reinforced vinyl binders with extensive indexing. Each sheet in the binder shall have hole reinforcements. Should there be any exceptions to the Specifications, the Supplier shall completely describe such in front of the

submittal via a point-by-point letter referencing the specification paragraph number. The hardware submittal shall be arranged as follows:

1. Front Cover – Project description and pertinent information
2. Review stamp page.
3. Table of Contents
4. Overall description of the system and overall BOM of equipment to be delivered
5. Block diagram of system, including network architecture and IP addressing
6. Complete Wiring diagrams, panel layouts/elevations, and panel BOMs
7. Complete manufacturer's information on all equipment, including highlighted catalog/model number data sheets
8. Complete list of spare parts
9. Warranty description and information.

In addition to the hardware submittal, a software submittal is required on this project and shall include the following additional information:

1. Sequence of Operations the new equipment and process
2. Preliminary Screen shots
3. Equations for calculations such as chemical feed pacing
4. Preliminary report layout/format
5. Preliminary trend layout/format
6. Table of alarms and proposed alarm functionality
7. Security protocols and provisions

The software submittal may be submitted subsequent to the hardware submittal if necessary for project schedule adherence.

B. Shop Drawings shall be submitted on all equipment and software specified in this Division unless a specific written exemption is obtained from the Engineer. The Contractor shall not procure or install any materials, equipment, or software without approved shop drawings.

C. The Engineer reserves the right to make modifications to instrumentation & SCADA equipment after Shop Drawing review, if the Instrumentation/SCADA Shop Drawings are submitted prematurely (prematurely meaning submitted before all process equipment has been reviewed and accepted). Cost of modifications shall be the Contractor's responsibility.

D. Operation & Maintenance Manuals: Manuals shall include the accepted shop drawing information along with the following additions:

1. Include complete addresses of all equipment manufacturing representatives and phone numbers of each.

2. Incorporate complete record drawings indicating final installation of equipment and wiring.

3. Include complete manufacturer's installation, operations, and maintenance manual for each piece of equipment and software supplied. Note, if the manufacturer's manual exceeds 50 pages in length, include only a place-holder page that directs the reader to the USB thumb drive electronic documentation.

4. Complete as-built overall Bill of Materials, and BOM for each panel.

5. Include a configuration record for each piece of equipment, including all parameter settings and set points.

6. Include calibration certificates for Instrumentation.

7. The manuals shall include a USB thumb drive which include electronic version of all of the above information, along with the following additional information:

   a. Backup of all programs developed in the course of the project.
   b. Backup of all reports, databases, set point listings, and all other electronic information utilized in the project.
   c. Manufacturer O&M manuals which exceed 50 pages in length.
   d. Software license documentation
   e. Backup of any other software pertinent to documenting or restoring instrumentation/SCADA system operation in the event of a failure.

1.04 QUALITY ASSURANCE

A. The Contractor shall be a factory authorized representative capable of start-up services of the equipment or shall provide the services of a factory authorized representative.

B. The instrumentation/SCADA system shall be furnished as an "open" system that can be modified and updated by the Owner or by any of the Owner's designated representatives. Proprietary systems will not be considered. The Owner reserves the right to cancel any post-construction service contract at any time due to quality of service or any other reason as determined by the Owner.

C. The Contractor shall have at least five years experience within the last five years in the design, manufacture, installation, calibration, and commissioning of instrumentation/SCADA systems of similar size and complexity to this project.

D. The Contractor's project manager for the instrumentation/SCADA portion of the Contract shall have a minimum of a Bachelor's degree in Engineering or similar from an ABET accredited university.

1.05 SYMBOLS AND ABBREVIATIONS

A. The symbols and abbreviations generally follow standard instrumentation and electrical practice, however, exceptions to this shall be as shown on the Contract Drawings.

1.06 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate the instrumentation/SCADA work with that of other trades to ensure proper installation and functionality of all equipment and process control/monitoring programs. Installation of equipment may be performed by other trades unless specified otherwise.

1.07 CODES

A. The minimum standard for all work shall be the latest revision of the Kentucky Building Code (KBC), and the National Electrical Code (NEC). Whenever and wherever state and/or local laws or ordinances and/or regulations and/or the Engineer's design require a higher standard than these codes, then these laws and/or regulations and/or the design shall be followed.

B. Following is a list of other applicable Standards or Codes:

1.	Kentucky Building Code	KBC
2.	National Electrical Code	NEC
3.	International Electrotechnical Commission	IEC
4.	Underwriters Laboratories, Inc.	UL
5.	Factory Mutual System	FM
6.	National Fire Protection Association	NFPA
7.	National Electrical Manufacturers Association	NEMA

8.	Occupational Safety and Health Administration	OSHA
9.	National Institute of Standards and Technology	NIST
10.	Instrument Society of America	ISA
11.	Institute of Electrical and Electronic Engineers, Inc.	IEEE
12.	American National Standards Institute, Inc.	ANSI
13.	Federal Communications Commission	FCC

1.08 STORAGE

A. All work, equipment, and materials shall be protected against dirt, water, or other injury during the period of construction.

B. Sensitive instrumentation/SCADA equipment shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed. Instrumentation/SCADA equipment shall not be installed until the structure is under roof with doors and windows installed.

1.09 ERRORS, CORRECTIONS, AND/OR OMISSIONS

A. Should a piece of process equipment be supplied of a different type or manufacturer than shown or specified in the Contract documents, the Contractor shall be responsible for installing, programming, and commissioning the proper instrumentation/SCADA equipment for proper operation, control, and monitoring of that process equipment at no extra cost to the Owner.

B. It is the intent of these Specifications to provide for an instrumentation/SCADA system installation complete in every respect, to operate in the manner and under conditions as shown in these Specifications and on the Contract Drawings. The Contractor shall notify the Engineer, in writing, of any omission or error at least 10 days prior to opening of bids. In the event of the Contractor's failure to give such notice, he/she may be required to correct work and/or furnish items omitted without additional cost. The submission of a bid indicates that the Contractor believes the design to be sound and can provide a fully functional and complete instrumentation and SCADA system. Further requirements on this subject may be found in the General Requirements, Division 1.

1.10 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee all work including equipment, materials, and workmanship. This guarantee shall be against all defects of the electrical system or improper equipment operation. It shall last for the period of time specified in the General Conditions of the Contract, but not less than one year from the date of system acceptance (i.e. – when the Engineer accepts that the punchlist is complete.) On-site response within 24 hours is required, at no additional cost, for problems experienced within the warranty period.

B. Return visits – the Contractor shall provide a minimum of one one-day return visit after final completion to implement additional software items as requested by the Owner. The costs for these return visits shall be included in the bid price.

C. Equipment manufacturers shall provide a minimum of one-year of technical support and software updates dating from final acceptance. The costs of this shall be included in the bid Certification of this shall be provided to the Owner with the O&M manuals.

1.11 TESTING

A. After the instrumentation/SCADA system is complete, and at such time as the Engineer may direct, the Contractor shall conduct an operating & performance test for acceptance. The system shall be demonstrated to operate in accordance with the requirements of these Specifications and the Contract Drawings. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments, hardware, software, and personnel required for the tests.

1.12 ADDRESSING

A. The Contractor is responsible for coordinating IP addresses

1.13 TRAINING

A. All manufacturers supplying equipment for this division shall provide the Owner's operations staff with training in the operation and maintenance on the equipment being furnished. The training shall be conducted at the project site by a qualified representative of the manufacturer.

B. The cost of this training shall be included in the bid price.

C. The required training shall consist of both classroom and hands-on situation. Classroom training shall include instruction on how the equipment works, its relationship to all accessories and other related units, detailed review of shop drawings, detailed presentation of written O & M instructions, troubleshooting and record-keeping recommendations. Hands-on-training shall include a review of the manufacturer's O & M instructions, check out of each operator as to identifying key elements of the equipment, tear down as appropriate, calibration, adjustment, and operating manipulations of all controls.

D. The training shall be scheduled through the Contractor with the Owner. The timing of the training shall closely coincide with startup of the equipment, but no training shall be conducted until the equipment is operational. The training program shall not begin until operations and maintenance manuals have been reviewed and sent to the Owner. Training shall use the accepted O & M manuals.

E. The training program length shall be as described in the individual Division 17 sections.

F. At least 30 days prior to the training the manufacturer shall submit through the Contractor to the Engineer an outline of the training proposed for the Engineer's review and concurrence.

1.14 RECORD DRAWINGS

A. The Contractor shall maintain 1 set of the Contract Drawings on the job in good condition for examination at all times. The Contractor's qualified representative shall enter upon these drawings, from day to day, the actual record of construction and/or alteration progress. Entries and notes shall be made in a neat and legible manner and these drawings delivered to the Engineer after completion of the construction, for use in preparation of Record Drawings.

1.15 MAINTAINING CONTINUOUS PROCESS CONTROL AND MONITORING SYSTEM

A. Existing system(s) continuity shall be maintained at all times. In no way shall the installation and/or alteration of the instrumentation/SCADA work interfere with or stop the normal operation of the existing facilities, except where prior arrangements have been made.

B. When additions and modifications to existing system(s) require outages of duration in excess of a few minutes, arrangements shall be made in advance for such outages. All outages shall be held to an acceptable minimum with none exceeding 1 hour continuous duration. If necessary, outages shall be performed on premium time. Under no circumstances shall a process control/monitoring outage of

any duration be initiated until the Owner and Engineer have concurred, and as far as possible in advance.

1.16 RECEIPTS

A. Some sections of the Specifications call for equipment, materials, accessories, etc. to be furnished and "turned over to the Owner" or like requirements. The Contractor shall obtain a receipt for each item turned over, signed by the Owner or his representative. A copy of this receipt shall be transmitted to the Engineer.

B. When a question arises concerning whether items have been turned over to the Owner, and there is no signed receipt, it may be assumed that the items were not furnished.

1.17 EXISTING NETWORK INTEGRATION

A. Contractor is responsible for investigating existing network and coordinating IP addressing of all new equipment. Documentation reviews and IP scans are required to identify all existing addresses in use. An updated network architecture diagram with IP addressing is required to be submitted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials used shall be new unless noted otherwise. All materials shall be UL listed for the application where a listing exists. Additional requirements are found in Division 1. All equipment shall meet applicable FCC requirements and restrictions.

B. The material and equipment described herein has been specified according to a particular trade name or make to set quality standards. However, each Contractor has the right to substitute other material and equipment in lieu of that specified, other than that specifically mentioned for standardization, providing such material and equipment meets all of the requirements of that specified and is accepted, in writing by the Engineer.

C. The reuse of salvaged equipment will not be permitted unless specified herein or indicated on the Contract Drawings.

PART 3 - EXECUTION

3.01 GROUNDING AND BONDING

A. All metallic conduit, cabinets, supporting framework and instrumentation/SCADA equipment shall be grounded in accordance with the latest issue of the National Electrical Code.

3.02 ANCHORING/MOUNTING

A. Instrumentation/SCADA equipment other than computer equipment located in the office/control room shall be rigidly supported as specified in Division 16.

B. All wall/surface mounted cabinets, panels, or other devices shall be mounted with a minimum 0.5" air gap between the cabinet and the wall.

END OF SECTION

SECTION 17012
INSTRUMENTATION/SCADA SUBMITTAL CHECKLIST

PART 1 - GENERAL

1.01 SUMMARY

A. This Section consolidates Instrumentation/SCADA submittal requirements found in the Division 17 specification sections into checklist tables. The checklist is intended as an administrative control document and does not replace the detailed requirements of the referenced specification sections.

1.02 SUBMITTAL CHECKLIST TABLES

A. Product Data/Shop Drawing Approval Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
17010	SCADA Network Diagram			
17200	SCADA Hardware	Prior to fabrication		

B. Software & Programming Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
17400	SCADA Software Development Submittal	Prior to Implementation		

C. Startup, Commissioning, and Test Reports

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
17010	SCADA Commissioning Report	Prior to substantial completion		
17100	Instrumentation Commissioning Reports	Prior to substantial completion		

D. Training Documentation Submittals

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
17010	SCADA Training	After commissioning		
17100	Instrumentation training	After commissioning		

E. O&M Manuals, Record Drawings, & Closeout Documentation

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
17010	Red-lined Record Drawings	At substantial completion		
17100	Instrumentation O&M manuals	At substantial completion		
17200	SCADA Hardware O&M manual	At substantial completion		
17400	SCADA software O&M manual	At substantial completion		
17400	SCADA software backup drive	Before final completion		

F. Spare Parts Delivery Documentation

Spec Ref.	Submittal / Deliverable	Timing / Prerequisite	Date Received	Date Approved
17100	Instrumentation Spare Parts	At substantial completion		
17200	SCADA Hardware Spare Parts	At substantial completion		

END OF SECTION

SECTION 17100
PROCESS INSTRUMENTATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide instrumentation as indicated on the Contract Drawings. Provide all materials, labor, spare parts, start-up services, as shown and specified and as required to install a complete, functional, calibrated instrumentation system.

B. Provide surge protection on instrumentation loops as specified herein.

C. Provide instrumentation training services.

D. Additional requirements are in Section 17010.

1.02 RELATED WORK

A. Installation of all electrical equipment, conductors, and related items shall be in accordance with all applicable sections of Division 16 of these specifications.

B. General Requirements are included in Division 1.

C. Division 11 – Equipment

D. Section 17010 - General Instrumentation and SCADA requirements.

1.03 SUBMITTALS

A. Shop drawing approval is required before the Contractor purchases or installs any equipment. Submit in accordance with Section 17010.

B. Operation and Maintenance Manuals shall be submitted in accordance with Section 17010.

1.04 QUALITY ASSURANCE

A. See Section 17010 for requirements.

B. Manufacturer NIST or equal calibration certificate is required for all instruments with an analog current or voltage signal output. Also, a field commissioning certificate is required for each analog instrument.

1.05 WARRANTY AND SERVICE

A. See Section 17010 for requirements.

1.06 SPARE PARTS

A. Furnish a one-year supply of any expendable parts (such as buffer solutions) for each device.

B. Ten fuses of each size/type in the system.

C. Provide calibration kits for turbidimeters and chlorine analyzers. Calibration equipment for the TOC analyzer shall be included with the required service plan.

1.07 TRAINING

A. Training shall be in accordance with Section 17010.

B. The instrumentation training program shall be a minimum of one 8 hour day on-site.

1.08 DELIVERY AND STORAGE

A. See Section 17010 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Acceptable manufacturers/suppliers for the instrumentation equipment shall be Hach, Vega, Rosemount, Foxboro, Endress-Hauser, ABB, or equal. Manufacturers of small peripheral equipment are listed with each piece of equipment.

B. All equipment shall be UL listed where a listing exists.

C. All electronic instrumentation equipment shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mA dc. No zero based signals will be allowed for remote transmission.

D. All instrumentation supplied shall be of the manufacturer's latest design and be compatible for the industry it is being applied.

E. All scales and readouts shall be direct reading in process units. Conversions are not acceptable.

F. All transmitters shall be provided with indicators, either integral or remote mounted, but must be within site of the transmitter unless specifically indicated otherwise on the Contract drawings.

G. All equipment must be able to reset after a power outage without having to be manually reset.

H. All circuit boards in instruments mounted outdoors, or in damp locations, shall be fungus proofed.

2.02 INSTRUMENTATION EQUIPMENT

A. Level Indicator

1. Indicators shall be a true two-wire device that derives its operating power from the 4-20 mAdc signal. Indication of level shall be presented using large 0.5 inch high liquid crystal displays. Units shall be direct reading in engineering units (FT).

2. All units shall be equipped with a 4-20 mAdc compensated output signal representing actual level.

3. The unit shall be enclosed in an aluminum IP-67 enclosure.

4. Indicator shall be Vegadis 82, or equal.

5. Provide a Vega PLICSCOM module with Bluetooth communications.

B. Radar Level Sensor and Transmitter

1. The radar instrumentation shall be Vega C21/C22, or equal.

2. The sensor shall be microprocessor-based and shall provide continuous, non-contact level measurement of liquids and solids utilizing the radar method.

3. The sensor shall be capable of distinguishing between real echoes, reflections, and background noise.

4. The sensor shall automatically compensate for temperature changes.

5. The sensor shall be NPT mounted to a flange as indicated on the Contract drawings.

6. It shall be rated NEMA 6P: submersible.

7. Sensor range shall be as indicated on the Contract drawings.

8. Mounting assembly shall be suitable for service without requiring entry or drainage of the wetwell where level is being measured.

9. The transmitter shall be capable of operating from an input supply voltage range of 12 to 35VDC.

11. The transmitter shall have an analog 4-20 mA isolated output to indicate level.

12. The transmitter shall have Bluetooth communications and a mobile app for setup and maintenance.

C. Pressure Cell & Transmitter

1. The transmitter shall be Foxboro Model IGP20, Vega, or equal, for measuring gauge pressure.
2. The transmitter shall loop-powered
3. The transmitter shall transmit a 4-20 mA signal when supplied with voltage in a range from 11.5 to 42 VDC
4. The transmitter shall have an LCD display with on-board pushbuttons
5. The transmitter shall have an external zero adjustment
6. The transmitter shall have a Type 316 stainless steel cover and housing. It shall be rated NEMA 4X.
7. The transmitter range shall be as indicated on the Contract drawings.
8. The transmitter shall be equipped with a two-valve manifold, stainless steel
9. Accuracy shall be +/-0.075 percent of calibrated span, minimum. Repeatability shall be better than 0.5 percent of calibrated span.
10. The transmitter shall be equipped with HART communications.
11. Mounting bracket, if used, shall be stainless steel.
12. Manufacturer warranty shall be 5 years, minimum.

D. Turbidimeter System, Low Range

1. The Turbidimeter system shall be a Hach Model TU5300 with SC4500 controller, or equal, to continuously indicate and transmit low range turbidity based upon Class 2 laser measurement. The SC4500 controller can be shared with the chlorine analyzer.
2. The system shall be suitable for regulatory reporting, and shall comply with USEPA 180.1 criteria.
3. The turbidimeter shall be suitable for continuous sample flow, and shall not be affected by flow or pressure variations.
4. The controller shall support datalogging, alarm history, and plug-and-play swap-out of turbidimeter.
5. Accuracy shall be +/- 2% of reading or +/-0.01 NTU (whichever is greater) from 0 to 40 NTU, minimum. Resolution shall be 0.0001 NTU.
6. The turbidimeter shall measure turbidity in the range of 0.001-700 NTU, and shall be scaled as indicated on the Contract drawings.
7. The turbidimeter body shall be constructed of corrosion-resistant non-metallic materials and rated IP55 minimum, with operation ambient from 32 to 122°F.
8. All necessary materials and equipment for calibration shall be provided.
9. An automatic cleaning module shall be provided.
10. A maintenance kit shall be provided.
11. Controller shall be NEMA 4X enclosed, suitable for 120VAC power supply. The controller shall have at least two 4-20mA analog outputs, and at least one alarm contact output.
12. Manufacturer warranty shall be 1 year, minimum.

E. Chlorine Analyzer

1. The chlorine analyzer shall be Hach Model CL17sc, or equal.
2. The chlorine analyzer shall employ a DPD colorimetric method of measurement compliant with US EPA regulation 40 CFR 141.74.
3. The analyzer shall be capable of measuring free or total residual chlorine as indicated on the Contract Drawings. It shall be capable of switching between free or total chlorine measurement by changing the indicator and buffer solutions.
4. A measurement shall be taken every 2.5 minutes and results displayed by a three digit LCD readout in the range of 0-5 mg/L
5. The analyzer shall be designed for 30-days unattended operation and use only 500 mL of each reagent per month.
6. The analyzer shall provide a minimum detection limit of 0.03 mg/L or better, precision better than 0.01 mg/L of Cl_2, and accuracy better than +/-5% or 0.04 mg/L of Cl_2.
7. The analyzer shall be provided with a controller/display unit, which can be shared with the turbidimeter. The controller shall provide two 4-20mA recorder outputs and 2 relay alarms. The alarms shall be user-selectable for sample concentration alarms (high or low and fully adjustable through the entire range), analyzer system warnings, or analyzer system shutdown alarms.
8. The analyzer and controller shall be housed in IP-66 rated, ABS plastic enclosures designed for wall mounting. The enclosure shall have a clear polycarbonate window for viewing the reagent levels.
9. The controller shall operate from voltage of 115 VAC +/-10%, 60Hz. It shall include a minimum 3-foot cord for plugging into a normal receptacle.
10. A standpipe installation kit shall be provided for sample conditioning.
11. A one-year supply of reagents shall be provided.
12. A calibration verification kit shall be provided.
13. A spare tubing kit shall be provided.
14. A cell cleaning kit shall be provided.
15. A pressure regulator kit shall be provided.

F. Electromagnetic Flowmeter and Transmitter

1. The electromagnetic flow meter shall consist of a flow sensor based on Faraday's Law of Electromagnetic Induction and microprocessor-based signal converter & transmitter.

2. The sensor flow tube liner material shall be EPDM rubber for drinking water applications. Measurement and grounding electrodes shall be 316 stainless steel. Flow tube shall have corrosion resistant epoxy coating. Flow meters shall be approved by NSF.
3. Assembly shall be NEMA 4X, both transmitter and flowtube.
4. Operating temp: Operating Temp: -5 to +120° F minimum acceptable band
5. Display: Background illumination with alphanumeric 3-line, 20-character display to indicate flow rate, totalized values, settings, and faults
6. Power supply: 115/230 VAC or 24VDC as indicated on Contract Drawings.
7. Outputs: 4-20 mA into 800 ohms max. One relay rated at 42 VAC/2 A, 24 DC/1A. Provide Digital pulse for external display of flow rate or totalizer.
8. Flow Range: 1.5 fps to 33 fps for accuracies stated below.
9. Accuracy: 0.5% of actual flow.
10. Separation: Allowable distance of 900 feet between signal converter and sensor without the use of any additional equipment
11. Provide Bi-directional flow capabilities
12. Totalizer: Two eight-digit counters for forward, net, or reverse flow.
13. The transmitter shall be mounted remotely as indicated on the Drawings. Provide the required cable.
14. Insertion type flow meters will not be accepted.
15. Provide ground rings where required by the mfr for proper operation.

G. Instrument Valves (1/4" through ¾")

1. Shutoff valves shall be provided on each pressure line to an instrument and accessory item, and shall be bronze ¼ turn ball valves with Teflon seats as manufactured by Whitey Co., Gould, Hoke, Apollo, or equal. Valves shall have a corrosion resistant handle.
2. Throttling valves where required and/or shown on the Contract Drawings shall be bronze globe valves, NUPRO "J" Series, Hoke 3700-3800 Series, or equal. Valves shall have a corrosion resistant handle.

H. Tubing

1. Tubing for pressure lines to transmitters shall be hard drawn copper or 316 stainless steel. Bulkhead fittings, bushings, etc., shall be those especially designed for the tubing and used at all terminations. Tubing shall be Type "L" copper bent with bending tools, so as to have a minimum number of joints. Solder joint fittings are not allowed; compression type shall be utilized, Swagelok or equal.
2. All runs of tubing shall be straight, parallel to walls with a slope to a drip leg at each connection to a transmitter, where the transmitter is below the primary element. Horizontal liquid-filled lines shall slope at least 1 inch per foot downward toward the measuring element to ensure that air or gas bubbles return to the main flow line or tank.

I. Total Organic Carbon (TOC) Analyzer

1. Provide analyzer for for continuous, online monitoring of Total Organic Carbon, Total Inorganic Carbon, Biological Oxygen Demand and/ or Chemical Oxygen Demand via correlation in water. Analyzer shall be Hach BioTector B3500dw online analyzer or equal.
2. The analyzer shall have internal sensors and shall utilize self-diagnostics to monitor analyzer status and produces alerts when maintenance or service are required.
3. The method of measuring Total Organic Carbon shall be by Two Stage Advanced Oxidation which utilizes the Hydroxyl radical and a manganese catalyst.
4. The analyzer shall automatically compensate for temperature and pressure using embedded sensors.
5. The analyzer shall include an SD card for data logging.
6. The analyzer shall include mounting brackets, reagent tubes, user manual, and all other components needed for a complete system.
7. Performance Requirements

i. Measurement range: 0 – 25mgC/l
ii. Detection Limit: 0.06mgC/l
iii. Repeatability: ±3% of reading or ±0.03mgC/l whichever is greater
iv. Cycle time: from 5.5 min, depending on range and application
v. Sample Flow: minimum 100ml per analysis
vi. Sample Pressure: Ambient
vii. Sample Temperature: 2 to 60 °C (36 to 140 °F)

8. The analyzer shall include qty (4) analog 4-20mA outputs and qty (6) relay outputs for status/alarm signaling.
9. The analyzer shall be the dual channel type which shall accept two inlet streams, calculating the TOC of both, and presenting a % removal display and signal.
10. The analyzer shall include a sample sensor to detect presence of the sample and evaluate the quantity of air bubbles in the sample.
11. The analyzer shall include a BioTector compressor and air filter pack for clean, dry instrument quality air supply.
12. The analyzer shall include a Modbus TCP ethernet port and communications protocol.
13. The analyzer shall include sampling overflow chambers for both sample streams.

2.03 SURGE PROTECTION FOR INSTRUMENTATION

A. Din-Rail-Mounted Surge Protection Device for Analog 4-20mA loops & Power Supply

1. The Din-Rail-Mounted surge protection device shall be installed at the termination end of the instrumentation loop where it enters the I/O cabinet.

2. The device shall have a surge handling capacity of 20kA (8/20microsecond) minimum. It shall have hybrid technology for “fine” voltage clamping and “coarse” surge current handling. The clamping voltage shall be less than or equal to 40V (Conductor to conductor) and 450V (conductor to ground). The response time shall be less than or equal to 1 nanosecond (conductor to conductor) or 100 nanoseconds (conductor to ground). The resistance of the device shall be no more than 2.2 ohms.

3. The device shall be suitable for din-rail mounting, and shall be no more than 17.5 mm thick. Temperature range shall be –40°C to 80°C.

4. The device shall be suitable for use on a 4-20mA analog circuit with 28VDC continuous operating voltage and up to 450mA continuous current.

5. Where the instrument being protected has a separate 24VDC power supply in addition to the analog current loop, the 24VDC supply circuit shall also be protected with a total surge current rating of 700A (8/20microsecond), clamping voltage less than or equal to 180V (conductor to conductor) or 550V (conductor to ground. Response time shall be 25nanoseconds (conductor to conductor) or 100 nanoseconds (conductor to ground).

5. The device shall be a Phoenix Contact “MCR-Plugtrab PT” surge protection device, or equal.

2.04 MISCELLANEOUS ACCESSORIES

A. Flange Adapters – Dresser Style 128 or equal for steel, ductile iron, or cast iron piping. Contractor must ensure the proper type of flange is procured. Provide restraints where specified in Division 2.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. General

1. All piping to and from field instrumentation shall be provided with necessary unions, tees, adapters, and shut-off valves.

2. Install all equipment in accordance with the manufacturer's installation and maintenance information.

3. Provide and install all necessary mounting equipment, brackets, required for mounting of equipment.

4. Instrument cables shall be pulled without undo stress that may aggravate the number of twists per foot. Shields shall be continuous and shall be only grounded at one end.

5. Place duct seal around the wires in each conduit entering every instrument enclosure for the project.

6. All instruments and equipment shall be left free from shipping burrs, paint overspray, grease, etc. All scratches shall be touched up with manufacturer's matching paint.

7. Provide a Din-rail-mounted surge protection device at the I/O cabinet termination where required in the SCADA I/O table on the Drawings.

8. Install on each instrument, transmitter, recorder, indicator, etc., a plastic engraved white with black letters nameplate secured to the panel. Nameplates shall be permanently secured with stainless steel screws if it does not interfere with the NEMA rating of the box. Instruments shall be supplied with a stainless or aluminum engraved tag with black letters if no flat spot exists for a nameplate. Chain shall be stainless steel.

9. Locate instruments as shown on the electrical drawings and primary elements as shown on the electrical or plant process drawings.

10. Transmitters or indicators shall not be mounted from process piping or hangers, only the building structure.

11. Remove all shipping tags, lifting rings, from enclosures. Plug all non-used holds in enclosures.

12. The system supplier shall coordinate the installation through the Contractor.

13. The placing and location of system components, their connections to the process equipment panels, cabinets and devices, shall be coordinated with the Engineer's acceptance.

14. Magmeters shall be installed with flange adapters to facilitate installation and removal.

3.02 STARTUP SERVICES

A. After equipment and materials have been shipped to the job site, the Contractor shall furnish the services of a factory-trained service technician or engineer to assist and advise the Contractor during installation and to provide calibration/adjustment at initial startup.

B. Following installation, checkout, and final adjustment of all panels, instruments, meters, monitoring, and control devices, the Contractor shall schedule a performance test in the presence of the Engineer on all equipment. The Contractor shall furnish the services of servicemen, all special tools, calibration equipment, and labor to perform the tests.

C. Meters shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale, if possible. All status and alarm switches as well as all monitoring and control functions shall also be checked. Testing shall be done from the signal source to the final element or device including all field wiring.

D. If, during running of the tests, one or more points appear to be out by more than the system accuracy statement, the Contractor shall make such adjustments or alterations as are necessary to bring equipment up to specification performance. Following such adjustment, the tests shall be repeated for all specified points to ensure compliance.

END OF SECTION

SECTION 17200
SCADA HARDWARE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install all materials, services, spare parts, start-up services, as shown and specified and as required to install a complete and functional supervisory control and data acquisition (SCADA) system as indicated on the Drawings and as described herein.

B. Provide power line, I/O point, and fieldbus/dataline surge protection as indicated and as specified herein.

C. Provide SCADA hardware training services as specified herein.

D. Additional requirements are specified in Section 17010.

1.02 RELATED WORK

A. Installation of all electrical equipment, conductors, and related items shall be in accordance with all applicable sections of Division 16 of these specifications.

B. General Requirements are included in Division 1.

C. Division 11 – Equipment

D. Section 16710 – Telecommunications Equipment

E. Section 16900 – Control Panels

F. Section 17010 - General Instrumentation and SCADA requirements.

G. Section 17400 – SCADA Software

1.03 SUBMITTALS

A. Shop drawing approval is required before the Contractor purchases or installs any equipment. Submit in accordance with Section 17010.

B. Operation and Maintenance Manuals shall be submitted in accordance with Section 17010.

1.04 QUALITY ASSURANCE

A. See Section 17010 for requirements.

1.05 WARRANTY AND SERVICE

A. See Section 17010 for requirements.

1.06 SPARE PARTS

A. Furnish one spare processor unit for each unique processor installed.

B. Furnish one spare I/O Module for each unique I/O module type installed.

C. Furnish one spare communication module for each unique communication module installed.

D. Furnish one spare power supply for each unique power supply installed.

E. Ten fuses of each size/type in the system.

F. Ten Lamps of each type used in the system.

1.07 TRAINING

A. Training shall be in accordance with Section 17010.

B. The on-site SCADA hardware training shall be a minimum of one-half day on-site.

1.08 TERMINOLOGY

A. CCC – Central Control Cabinet: Includes main programmable controller, inputs, outputs, and other required equipment.

B. DCC – Distributed Control Cabinet: Includes compact programmable controller, inputs, outputs, and other required equipment. The compact controller can communicate with the main controller and other compact controllers via the plant network.

C. IOC – Input-Output Cabinet: Includes inputs and outputs which are addressed and controlled from the main programmable controller.

D. MTU – Master Telemetry Unit: A radio with associated equipment used to communicate to remote locations.

E. RTU – Remote Telemetry Unit: A radio with inputs and outputs used to communicate with the master telemetry unit or other remote telemetry units.

F. PLC – Programmable logic controller

PART 2 – PRODUCTS

2.01 GENERAL

A. Acceptable manufacturers of SCADA hardware shall be Allen-Bradley, Siemens, General Electric, Modicon, or equal. Manufacturers of small peripheral equipment are listed with each piece of equipment.

B. All equipment must be able to reset after a power outage without having to be manually reset.

C. All equipment mounted outdoors shall be protected from the sunlight, and extreme temperatures between –20 degrees and 140 degrees Fahrenheit. Provide all necessary shielding, heaters, or air conditioners as required. All externally mounted panels shall have self-sacrificing corrosion inhibitors installed.

2.02 SCADA CABINETS

A. General: All control cabinets shall be provided compliant with Section 16900 and with the following features:

1. Enclosure: Sized for 25% spare panel space with a single 3-point roller latch. Screw clamps are unacceptable. NEMA rating shall be as indicated on the plans (NEMA 12 minimum). Aluminum

cabinets shall not be used in uncontrolled temperature environments due to thermal expansion issues. Components installed in the exterior of the enclosure shall maintain the NEMA rating of the enclosure. All enclosures shall have a padlock hasp.

2. Rotary IEC style lockable main disconnect with main circuit breaker and transient voltage surge suppression with alarm contact.

3. Uninterruptible power supply (UPS) with alarm contact. A power relay shall be provided and wired such that, if the UPS fails the relay shall drop out and the panel shall be powered from utility power.

4. Ethernet switch with ports as required (2 spare ports required, minimum), and CAT-6 Ethernet wiring. Shall include SFP port for fiber connection.

5. Provide 24VDC power supply, miscellaneous breakers, fuses, terminal blocks, wiring duct, and other panel components

6. interior GFCI protected duplex receptacle

7. Provide prewired with all field wiring landed on terminal blocks for field installation

B. Central Control Cabinet (CCC/MTU) – the existing MTU cabinet shall remain. Provide SFP modules for the existing STRATIX switch as indicated on the Drawings.

C. Distributed Control Cabinet (DCC) – Provide with the following features:

1. Compact programmable controller, modular and chassis based with all required inputs and outputs and communications modules as required to meet the requirements of the Contract drawings and these specifications. Chassis shall be expandable for future I/O modules

D. Input/Output Cabinet (IOC) – Provide with the following features:

1. Communications adapter and remote inputs and outputs as required to meet the requirements of the Contract drawings and these specifications. Provide 25% spare I/O, and arranged for future I/O expansion.

2.03 CONTROLLERS AND I/O

A. Compact Programmable Controller and chassis-based I/O
   1. The compact programmable controller shall be Allen-Bradley CompactLogix, or equal.
   2. The compact programmable controller shall include a chassis, power supply, processor, I/O modules, communications modules, cables, and all other components required to make a complete, functional system.
   3. The compact programmable controller shall be programmable with the same software program as the main programmable controller
   4. Processor Unit:
      a. Provide 5069-L320ER.
      b. Processor Memory: 2 megabytes, battery backed RAM, minimum
      c. Capability of controlling up to (16) local I/O modules
      d. Shall have typical throughput Time of 0.08 ms/K based upon a 1K ladder logic program consisting of simple ladder logic and communications servicing.
      e. Shall have Bit Execution Time of less than 0.51 microseconds
      f. Shall support Proportional Integral Derivative Control with up to 451 microsecond execution time
      g. Shall support online programming including runtime editing

h. Memory Back-up provided through minimum two year lithium battery
i. LED indicators including: POWER, RUN, Fault, Network status
j. One USB port
k. Shall support a Real Time Clock
l. The processor shall support Ethernet communications via RJ-45 connection
m. Provide a SD card for non-volatile program storage.

5. Discrete Input Modules
   a. Provide 16 inputs, minimum.
   b. Shall include removable terminal block
   c. Shall include LEDs to indicate the status of each I/O point
   d. Shall include optical isolation between digital and field circuits
6. Discrete Output Modules
   a. Shall be either a relay output module with minimum (8) individually isolated outputs, or a transistor output type with minimum (16) outputs and interposing relays provided.
   b. Shall include removable terminal block
   c. Shall include LEDs to indicate the status of each I/O point
   d. Shall include optical isolation between digital and field circuits
7. Analog Input Modules
   a. Provide minimum (4) isolated input channels per module
   b. Current Rating of 0 to 20mA, 4 to 20mA
   c. Minimum resolution of 14 bits
   d. Input Group to Bus Isolation of 500Vac for (1) minute
   e. Removable terminal block
   f. LEDs to indicate the status of each I/O point
8. Analog Output Modules
   a. Provide minimum (4) isolated output channels per module
   b. Current Rating of 0 to 20mA, 4 to 20mA
   c. Shall drive a resistive load of minimum 500 ohms.
   d. Resolution of 14 bits minimum
   e. Open and short-circuit protection
   f. Output voltage protection
   g. Input Group to Bus Isolation of 500V ac for (1) minute
   h. Removable terminal block
   i. LEDs to indicate the status of each I/O point
9. Remote I/O: Remote I/O shall be CompactLogix Type 5069 I/O as specified above with a 5069-AENTR Ethernet/IP adapter module.

2.04 COMPUTERS

A. The existing SCADA computers shall remain and be reused for this project.

2.06 OPERATOR INTERFACE

A. Human Machine Interface
   1. The operator interface panel shall be Allen-Bradley PanelView Plus 7, or equal.
   2. Unit shall have minimum 12” dimensions.
   3. Unit shall be rated NEMA 4X.
   4. The display type shall be Active Matrix Thin Film Transistor (TFT) color. Resolution of 640x480 with 18 bit color minimum is required.
   5. Unit shall include a real time clock, battery backed, with timestamp ability.
   6. Operating temperature shall be 32 to 131 degrees F.
   7. The keypad shall have at least 32 keys.
   8. Communications shall be Ethernet/IP
   9. Unit shall include 64MB of RAM and 64MB of flash memory storage.

10. Unit shall be UL listed.
11. The display shall have a field replaceable backlight.
12. The display shall have anti-glare and high-brightness technology installed for exterior utilization in sunlight.
13. The display shall have conformal coating on the circuit boards for corrosion resistance.
14. Unit shall include the development and runtime versions of the required programming software.

2.07 SURGE SUPPRESSION

A. Cabinet Power Supply Surge Protective Device (SPD)

1. The power supply SPD shall be a Din-Rail-Mounted device and shall be installed to protect the equipment in the cabinet from harmful surges and voltage spikes.

2. The SPD shall have nominal ratings of 120VAC and 26A minimum. Temperature range shall be –40°C to 80°C.

3. The device shall have a surge handling capacity of 10kA (8/20microsecond) minimum. It shall have hybrid technology for “fine” voltage clamping and “coarse” surge current handling. The clamping voltage shall be less than or equal to 500V. The response time shall be less than or equal to 25 nanoseconds.

4. The device shall be a Phoenix Contact “Mains-Plugtrab PT Series,” or equal.

B. Analog I/O SPD

1. The Din-Rail-Mounted surge protection device shall be installed to protect the analog SCADA I/O.

2. The device shall have a surge handling capacity of 20kA (8/20microsecond) minimum. It shall have hybrid technology for “fine” voltage clamping and “coarse” surge current handling. The clamping voltage shall be less than or equal to 40V (Conductor to conductor) and 450V (conductor to ground). The response time shall be less than or equal to 1 nanosecond (conductor to conductor) or 100 nanoseconds (conductor to ground). The resistance of the device shall be no more than 2.2 ohms.

3. The device shall be suitable for din-rail mounting, and shall be no more than 17.5 mm thick. Temperature range shall be –40°C to 80°C.

4. The device shall be suitable for use on a 4-20mA analog circuit with 28VDC continuous operating voltage and up to 450mA continuous current.

5. The device shall be a Phoenix Contact “MCR-Plugtrab PT” surge protection device, or equal.

C. Digital 24VDC I/O SPD

1. The SPD shall be DIN-rail-mountable and shall be installed to protect the digital 24VDC SCADA I/O. Temperature range shall be –40°C to 80°C.

2. The device shall have a surge handling capacity of 10kA (8/20microsecond) minimum. It shall have hybrid technology for “fine” voltage clamping and “coarse” surge current handling. The clamping voltage shall be less than or equal to 42VDC. The response time shall be less than or equal to 25 nanoseconds. The resistance of the device shall be no more than 4.7 ohms.

4. The device shall be suitable for use on 24VDC circuit with up to 300mA continuous current.

5. The device shall be a Phoenix Contact “MCR-Plugtrab PT” surge protection device, or equal.

C. Digital 120VAC I/O SPD

1. The SPD shall be DIN-rail-mountable and shall be installed to protect the digital 120VAC SCADA I/O. Temperature range shall be –40°C to 80°C.

2. The device shall have a surge handling capacity of 10kA (8/20microsecond) minimum. It shall have hybrid technology for “fine” voltage clamping and “coarse” surge current handling. The clamping voltage shall be less than or equal to 600V. The response time shall be less than or equal to 25 nanoseconds.

4. The device shall be suitable for use on a 120VAC circuit with up to 26A continuous current.

5. The device shall be a Phoenix Contact “MCR-Plugtrab PT” surge protection device, or equal.

2.08 MISCELLANEOUS EQUIPMENT

A. Din Rail Mount Uninterruptible Power Supply (UPS) – For use inside enclosures.
1. The UPS shall be manufactured by Sola, Allen-Bradley, or equal.
2. The UPS shall be designed for Din rail mounting inside industrial control panel enclosures. It shall have screw terminations for all wiring points.
3. The UPS shall operate off of 120V +/-10% with a capacity of 500VA.
4. The UPS shall be UL 1778 recognized.
5. The UPS shall have a dry contact to indicate alarms.
6. The UPS shall have integral overload protection.
7. Operating temp shall be 0-50 degrees C.
8. The UPS shall handle normal shock and vibration of industrial use without damage.

B. Loop Isolator and Signal Converters: The loop isolator or signal converter shall be provided where indicated or specified, to isolate signals or to increase the load capacity of a system required to have many devices in the loop. Isolators shall provide 3-way isolation and shall have a power supply voltage of 120VAC unless otherwise indicated. Isolators and converters shall be Action Instruments, Phoenix Contact, or equal, and enclosed as appropriated for the application or as indicated.

2.09 DATA HIGHWAYS AND ASSOCIATED EQUIPMENT

A. Link the equipment into an integrated ethernet network.

B. Plant-wide Network

1. Programmable controllers and distributed I/O blocks shall include an Ethernet Adapter port. The selected messaging protocol for this port shall be TCP/IP and shall provide high throughput with error detection and correction.

2. The network shall operate at a speed of 100M bits per second or faster.

C. Provide cables as required to interconnect each network component. Provide all cables and connectors for programmable products. Cables shall be installed in conduit and/or underground duct under Division 16.

1. New cabling shall be equal to Belden Category 6 UTP, or equal.

2. New cabling underground or as shown on the Contract Drawings shall be fiber optic as specified in Section 16710.

D. Ethernet Switches – Unmanaged (for IOC-MIOX cabinet)

1. The Unmanaged Ethernet switch shall be IEEE 802.3 compliant.
2. Port Densities: All switches shall be sized for two (2) spare ports in addition to the ports indicated on the plans.
3. Port Configurations: All switches shall be Copper 10/100TX with RJ-45 connections. Fiber optic ports are acceptable and encouraged in lieu of using media converters.
4. Auto-negotiation: All Copper TX ports shall support auto negotiation. Each TX port will be able to interface to 10/100 meg or full/half duplex devices.
5. AutoCross: All TX ports will provide cable autocross capability.
6. The address table shall have a minimum capacity of 4000 addresses.
7. The switch shall contain an alarm contact that can be configured via standard web browser to annunciate the drop out of either or both power supply inputs and/or to annunciate the active link status of any combination of ports. An LED shall be provided to indicate the status of the alarm contact.
8. The switch shall also have power supply, link active, and communications status LEDs
9. The Switch shall be din rail mountable out of the box and without the need to add/assemble adaptor or similar mounting plates.
10. All power and alarm connections shall be wired using removable connectors.
11. The switch shall be powered by a nominal 24VDC, 120VAC, or as shown on the Contract Drawings
12. The Switch shall have provision for supporting redundant power inputs. Power supply switchover will not interrupt switch operation.
13. Provision will be made such that the loss of one or more power supply may be user configurable to trigger a hardware alarm (ie relay contact)
14. The Switch shall have an operating temperature range of 0° to 55° C or greater
15. The switch shall withstand a maximum continuous operating humidity of 95% without condensation.
16. Electrical Noise Immunity: The switch shall conform to the IEC61000-4-2 to 4-8 series of noise specifications
17. Shock and Vibration: The switch shall conform to IEC60068-2-27 and withstand a shock pulse of 25G or more for 11ms. The operating vibration spec shall conform to IEC60068-2-6 (Criterion 3) at 5G 150Hz, in all 3 axis.
18. Agency Certifications: The switch will be certified for UL/Cul 508, UL 1604 Class1 Div 2 hazardous locations, CE
19. The switches shall be Phoenix Contact Unmanaged Ethernet Switches, or equal.

E. Ethernet Switches – Managed (for IDF-GAC rack)

1. See requirements in Section 16710

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Install all equipment in accordance with the manufacturer's installation and maintenance information.

B. Provide and install all necessary mounting equipment, brackets, required for mounting of equipment.

C. Data highway cables shall be pulled without undo stress that may aggravate the number of twists per foot.

D. Place silicone caulk around the wires in each conduit entering every SCADA cabinet for the project.

E. All equipment shall be left free from shipping burrs, paint overspray, grease, etc. All scratches shall be touched up with manufacturer's matching paint.

F. Provide SPDs on the power supply circuit to each SCADA cabinet. Provide SPDs on each analog and digital termination.

G. Locate equipment as shown on the electrical drawings.

H. Remove all shipping tags, lifting rings, etc. from enclosures. Plug all non-used holes in enclosures.

I. The placing and location of system components, their connections to the process equipment panels, cabinets and devices, shall be coordinated with the Engineer's acceptance.

3.02 STARTUP SERVICES

A. Following installation, checkout, and final adjustment of all hardware, the Contractor shall schedule a performance test in the presence of the Engineer on all equipment. This test shall be concurrent with the SCADA software test.

END OF SECTION

SECTION 17400

SCADA SOFTWARE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide SCADA software development, testing, commissioning, and maintenance services as specified herein. Provide all materials, labor, software, and services as required to implement a complete and functional system.

B. Integrate each I/O point indicated on the Contract drawings into the SCADA software.

C. Provide software operation training.

1.02 RELATED WORK

A. General requirements are located in Division 1.

B. Section 17010 – General Instrumentation/SCADA Requirements

C. Section 17200 – SCADA Hardware

1.03 SUBMITTALS

A. Software submittals shall be submitted in accordance with Section 17010.

B. Operation & Maintenance manuals shall be submitted in accordance with Section 17010.

1.04 QUALITY ASSURANCE

A. See Section 17010 for requirements.

1.05 WARRANTY & SERVICE

A. See Section 17010 for requirements.

1.06 TRAINING

A. Software training shall comply with Section 17010 requirements.

B. Onsite Software Training: Onsite software training shall be conducted by the Contractor and shall consist of a minimum of one half day.

1.07 GENERAL SCADA SOFTWARE REQUIREMENTS

A. The existing Rockwell SCADA Software shall be used for this project. Contractor shall integrate the new equipment/processes into the existing application.

PART 2 – PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 SOFTWARE SERVICES

A. General: Software services shall include program development, testing, documentation, and work necessary to implement a complete and fully operating system as shown on Drawings and as specified. Work requires coordination with concurrent program development for programmable controllers (PLCs), I/O data collection, operator interfaces, and reports.

B. Programmable Controller Logic: Develop programs for execution on the specified PLCs. Logic shall perform functions required to control processes and equipment as shown on Drawings and as specified below. Develop complete cross-references for ladder logic and complete input/output listings.

C. Communication Drivers: Configure communication drivers to communicate data from the PLCs to the SCADA software. The drivers shall be arranged on (2) I-O servers in a redundant manner such that the failure of an individual I-O server will not affect SCADA system operation. PLCs on the local hard-wired network shall be polled once per second.

D. SCADA Interface Screens:

1. Provide graphic representation of plant processes and control over machinery. Video displays shall be color at a minimum 1080P resolution. Provide process-oriented displays showing current process status and accepting operator input for setpoint and equipment controls. Use colors, function keys, and navigational controls consistently.

2. For each display, show process elements such as pumps, valves, tanks, pipe lines, etc., with their current operational status. Emphasis shall be placed on depicting the plant in a “P&ID” format that allows easy conceptualization of process flow rather than depicting equipment in actual physical location or scale.

3. Not running state: graphic shall be natural color with no motion.

4. Running state: Graphic shall be green color and shall rotate or show other type of motion as appropriate. Both color and motion shall be depicted.

5. Red color shall be reserved for alarm graphics.

6. Tanks shall include both analog and digital indication of current fill/level status. Also, static text must be added to indicate level at bottom of tank and top (or overflow) of tank.

7. Indicators shall use an appropriate number of significant digits and dead band to produce steady values.

8. Provide the following screens as a bare minimum:

a. Main Menu (update existing)
b. Overall Plant View (update existing)
c. MIOX Disinfection
d. GAC Treatment
e. Alarm Summary (update existing)
f. Alarm History (update existing)
g. Network Status (update existing)
h Trending
i. Power Monitoring
j. Elapsed Run Time Reports
k. Flow Total Reports

E. Alarms

1. Alarm Management: For each process or system event classed as an alarm provide facilities for displaying and logging in database, acknowledgment, and shelving. Alarm events shall be derived from discrete inputs, analog trip values, logic combinations and computations as needed. Log and display both alarm events and returns to normal. Provide date/time stamps for events, descriptive message, and event type code. Use color combinations to distinguish following alarm states: Alarm-Unacknowledged, Alarm-Acknowledged, Normal-Unacknowledged, and Normal-Acknowledged.

2. Provide the ability to disable any alarm at runtime – under supervisor security.

3. Provide the following alarms in addition to the alarms required in the I/O table on the Drawings:

   a. For each piece of equipment that is called to run by a controller and has a status feedback signal, provide a "Failure to Start" alarm that triggers 5 seconds after the equipment is called to run if it is not confirmed to be running by the feedback signal.

   b. For each 4-20mA instrument, provide a "Transmitter Failure" alarm that triggers if the signal falls below 3.8 mA or exceeds 20.2 mA. This alarm shall not be triggered if a power outage occurs.

   c. For each PLC or other networked device, provide a communication failure alarm. A "heartbeat" bit or register shall be monitored and if the heartbeat doesn't change within the timeout period then the communication alarm shall be triggered. The timeout period shall be 5 seconds for devices connected to the local hard-wired network. This timeout period shall be higher for devices or RTUs monitored via wireless or radio.

F. Trending

1. Provide on-screen preconfigured trending displays for the points indicated in the I/O Table on the Drawings. Provide facilities for user selection of colors, time (horizontal), and measurement (vertical) scales. The trends shall show real-time values and historical values over the past 12 hours by default. The trend displays shall have time-scale panning controls. All trends must have an adjustable cursor that indicates both Y and X axis values at the user-selected location. Each trend pen shall have an individual color and description.

2. In addition to the pre-configured trends, provide a custom trend screen where the operator can select any point in the database to add to the trend. The custom trend shall be saveable such that operator can return to the trend without redefining its configuration.

G. Security: Using operator interface and operating system software, implement a security system to restrict access to parts of system. Each operator shall be issued a username/password. Provide the following user groups as a minimum:

1. Administrator - Access to all facilities including changing displays and logic.

2. Supervisor – Shall have operator privileges along with the ability to adjust crucial setpoints or disable alarms.

3. Operator – Shall be able to view displays, control equipment, adjust minor setpoints, and acknowledge alarms.

4. Guest - Access to displays only.

H. Data Storage:

1. All tags, both analog and digital, shall be stored via “Delta” storage method. That is, a new value shall be stored only when the tag has changed an appropriate amount. Normally the delta storage should be triggered at 0.1% change against the tag’s maximum value, although this level may need to be adjusted if the tag has an abnormally wide range of operation.

2. Establish automatic backup of historical data on a daily basis. The data shall be stored on an external harddrive provided by the Contractor unless noted otherwise on the Drawings.

I. Reports:

1. Reporting requirements shall consist of both live HMI screens that dynamically update the report values and also published historical reports.

2. Daily totals shall be published and then reset to zero at midnight. Monthly totals shall be published and then reset to zero on the last day of the month at midnight.

3. Totalization time slices shall not exceed 5 seconds.

4. The following parameters shall be reported:

a. Motor & Equipment Run times: For each motor or piece of equipment that is monitored, report “Run Time Today” and “Run Time Yesterday”.

b. Flow Totals: For each flow meter, report “Flow Total Today”, “Flow Total Yesterday”, “Flow Total This Month”, and “Flow Total Last Month.”

5. The reports shall be published to Excel spreadsheets.

3.02 CONTROL SEQUENCES

A. General

1. Provide programming of control sequences to control equipment and processes.

B. GAC Pumps

1. The pumps shall have 3 modes of operation: hand, manual, and automatic. Hand mode shall be implemented by shifting the physical MCC HOA switch to hand position, and then starting and controlling the drive from its HIM module.

2. Manual mode shall be initiated by a software switch. There shall be a manual mode speed setpoint. The drive shall run at this setpoint while in manual mode unless the wetwell hits the low-low level at which point the drive shall be tripped off.

3. In automatic mode, the pumps shall be controlled by a variable speed pump-down algorithm. Implement the following minimum adjustable setpoints:

   a. High-High Alarm Level (trip plant low service pumps off)
   b. High Alarm Level
   c Pump On Level
   d. Max Speed Level and Max Speed Hz
   e. Min Speed Level and Min Speed Hz
   f. Pump Off Level
   g. Low Alarm Level
   h. Low-Low Alarm Level (trip GAC feed pumps off)

4. The pump speed shall vary linearly between the Min and Max speed level setpoints.

5. Only one pump shall run at a time.

6. When a pump HOA switch is not in Auto position, it shall be removed from the automatic control sequence.

7. Provide a software alternation switch. Operator shall be able to select automatic or locked alternation. Under alternation, automatic alternation shall occur with each cycle off.

C. TOC Analyzer

1. The TOC analyzer shall be enabled when the GAC pump is running. Otherwise it shall be placed in remote standby mode.

D. GAC Bypass Valve

1. The valve actuator shall have 2 modes of operation: hand and manual. An automatic sequence is not required.

2. Hand mode shall be implemented by using the onboard actuator hand controls in local mode.

3. Manual mode shall be initiated by a software switch. There shall be a manual mode position (% Open) setpoint. The actuator shall open to this setpoint while in manual mode.

E. Sample Pumps

1. The pumps shall have 3 modes of operation: hand, manual, and automatic. Hand

mode shall be implemented by shifting the physical starter HOA switch to hand position which will start the sample pump.

2. Manual mode shall be initiated by a software switch. When placed in manual mode, the sample pump shall run.

1. Automatic mode shall be controlled by the GAC pumps. When in automatic mode, the sample pumps shall be started if a GAC pump is running, and shall deenergize when no GAC pumps are running.

3.03 TIME SYNCHRONIZATION

A. All programmable controllers and associated HMIs on the project are required to be time-synchronized to the SCADA Historian using the Rockwell Clock update tool or equivalent programming method. This includes any Rockwell controllers/HMIs furnished by OEM/equipment manufacturers. The Historian shall be synchronized to an NTP server such as time.nist.gov or time.windows.com.

3.04 PERFORMANCE TEST

A. Following installation, checkout, and final adjustment of software, the Contractor shall schedule a performance test in the presence of the Engineer and the Owner.

B. Demonstrate to the Engineer and Owner that each I/O point scheduled on the Contract Drawings has been integrated and is functioning properly.

C. Demonstrate trending, reporting, and alarm messaging has been configured properly and is operational.

D. Software development shall not be accepted until the SCADA system functions for at least one week with no nuisance alarms. Nuisance alarms shall be as defined by the Engineer.

END OF SECTION

SOLID GROUND
CONSULTING ENGINEERS

REPORT OF GEOTECHNICAL EXPLORATION

Lebanon Water Treatment Plant

Lebanon, Marion County, Kentucky

Prepared for: Kentucky Engineering Group, PLLC

February 20, 2026

SOLID GROUND
— CONSULTING ENGINEERS —

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Appendix A BORING LOGS

Appendix B LAB RESULTS

SOLID GROUND
CONSULTING ENGINEERS

February 20, 2026

Mr. Ryan C. Carr, PE
Kentucky Engineering Group, PLLC
P.O. Box 1034
Versailles, KY 40383
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Subject: **Report of Geotechnical Exploration**
Granular Activated Carbon (GAC) Facility
Lebanon Water Treatment Plant
Lebanon, Marion County, Kentucky
Solid Ground Project No.: 26-121

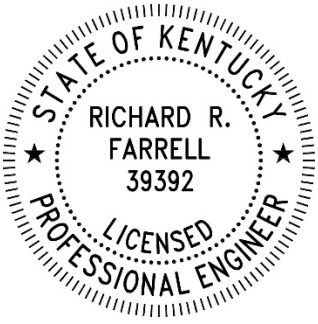
Mr. Carr,

Solid Ground Consulting Engineers (Solid Ground) is pleased to present our Report of Geotechnical Exploration. This report is for the proposed Lebanon Water Treatment Plant GAC Facility to be located in Lebanon, Kentucky. The geotechnical exploration was conducted in general accordance with the scope of work agreed upon via Solid Ground Proposal No. 100826 dated January 16, 2026.

This report contains our findings and recommendations for the referenced project detailed above. Once completed, it is recommended that Solid Ground have the opportunity to review plans and specifications. In addition, it is recommended that Solid Ground be retained to perform observations during earthwork, foundations, and slab-on-grade construction. Solid Ground will not be held responsible for interpretations and field observations made by others.

We appreciate the opportunity to provide our consulting services to you. We look forward to working with you on this and future projects.

Sincerely,
SOLID GROUND CONSULTING ENGINEERS,



Richard Farrell
Rich Farrell, PE
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Nathaniel O'Leary M.S., GIT
Staff Geologist

1.0 Executive Summary

Solid Ground Consulting Engineers performed a geotechnical exploration in support of the proposed Granular Activated Carbon (GAC) facility at the Lebanon Water Treatment Plant development located at Treatment Plant Road, Lebanon, Marion County, Kentucky. The approximate coordinates are 37.513946°N, -85.262423°W.

1.1 Summary of Findings

Solid Ground, along with Horn and Associates, conducted a total of six (6) soil test borings. One (1) of the soil borings was extended beyond auger refusal to include rock coring. All borings were located within the approximate project boundaries.

Soil overburden generally consisted of a layer of topsoil underlain by fill and natural soils described as Lean Clay (CL), Clayey Gravel (GC), Silty Clay (CL-ML), and Lean to Fat Clay (CL-CH) with varying amounts of sand, gravel, rock fragments, and silt to auger refusal depths.

All six (6) of the borings encountered auger refusal at depths from 8.7 to 21.3 feet. One (1) of the borings was advanced beyond auger refusal to include 10.0 feet of rock coring. Auger refusal is not interpreted as bedrock for design purposes; confirmation of bedrock should be based on coring and excavation observations. The preliminary finished floor elevation (FFE) of the GAC facility is currently set at 628.0 feet. The GAC pump room has a preliminary FFE of 588.67 feet, and the chemical feed room has a preliminary FFE of 606.67 feet. Based on existing grades, moderate to significant site grading may be required to facilitate construction as well as achieve the finished grades.

2.0 Project Information

2.1 Purpose and Scope of Services

The purpose of this subsurface exploration was to prepare recommendations for design and construction of foundations and floor slabs for the proposed GAC Facility. Our scope of work included the following:

- A discussion of site surface conditions.
- A discussion of subsurface conditions encountered as well as a discussion of the published geologic conditions at the site including frost penetration depth.

- A summary of field and laboratory testing results including a brief review of our test procedures.
- Boring logs and laboratory tests will be summarized in the report and listed in the appendix.
- A discussion of specific geotechnical conditions and concerns which may affect the design or construction of the project.
- General recommendations for site preparation and construction of compacted fills including use of alternative construction practices.
- Groundwater management recommendations.
- Liquefaction discussion.
- Recommendations for foundation design including bearing capacity.
- Anticipated immediate settlement and immediate differential estimates.
- A recommendation for seismic site class according to International Building Code which was adopted by the 2018 Kentucky Building Code (KBC).
- A brief review of our test procedures and the results of all testing conducted.

2.2 Project Description

The project consists of the new construction of a GAC facility at the water treatment plant located at Treatment Plant Road in Lebanon, Marion County, Kentucky. The approximate site location is depicted below in Figure 1.

Figure 1: Approximate Site Location

2.3 Site Conditions

Solid Ground personnel visited the site throughout the geotechnical exploration to observe existing conditions, to help interpret the subsurface data, and to detect conditions which could affect recommendations.

The site is located at Treatment Plant Road, Lebanon, Marion County, Kentucky. The site is currently covered in grass and trees and occupied by an abandoned railroad berm.

2.4 Structural Loading Information

Structural loads were not provided at the time of report preparation. For preliminary evaluation purposes only, a vertical load of approximately 400 kips was assumed for the GAC facility. Final foundation recommendations should be confirmed once project-specific loads are provided.

2.5 Site Grading and Topography

The preliminary FFE of the GAC facility is currently set at 628.0 feet. The GAC pump room has a preliminary FFE of 588.67 feet, and the chemical feed room has a preliminary FFE of 606.67 feet. Based on existing grades, moderate to significant site grading may be required to facilitate construction as well as achieve the finished grades.

3.0 Subsurface Findings and Encountered Conditions

3.1 Review of Previous Site Development and Historical Information

Based on review of historical maps provided by the United States Geological Survey (USGS) (Figures 2 & 3) and historical imagery provided by Google Earth (Figures 4 & 5), it appears the site has remained relatively unchanged in recent years. Historical imagery shows the former railroad track that runs directly through the site was covered sometime between 1985 and 1998, along with the demolition of the bridge directly south.

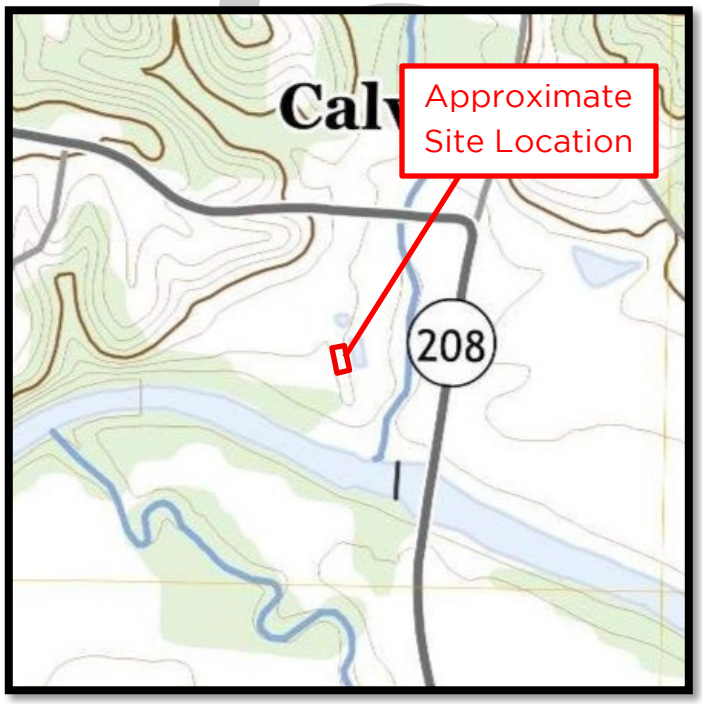


Figure 2: 2022 USGS Topographic Map of Lebanon West Quadrangle

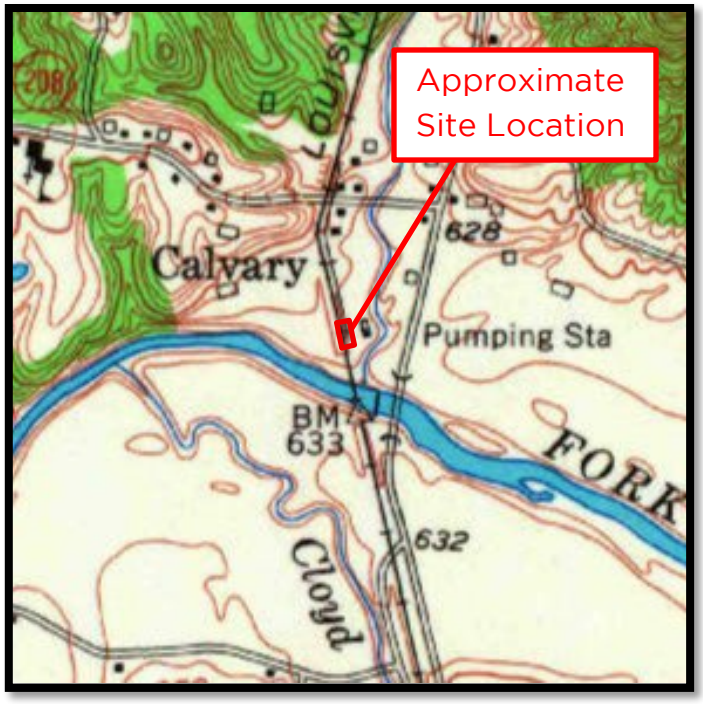


Figure 3: 1953 (1968 ed.) USGS Topographic Map of Lebanon West Quadrangle

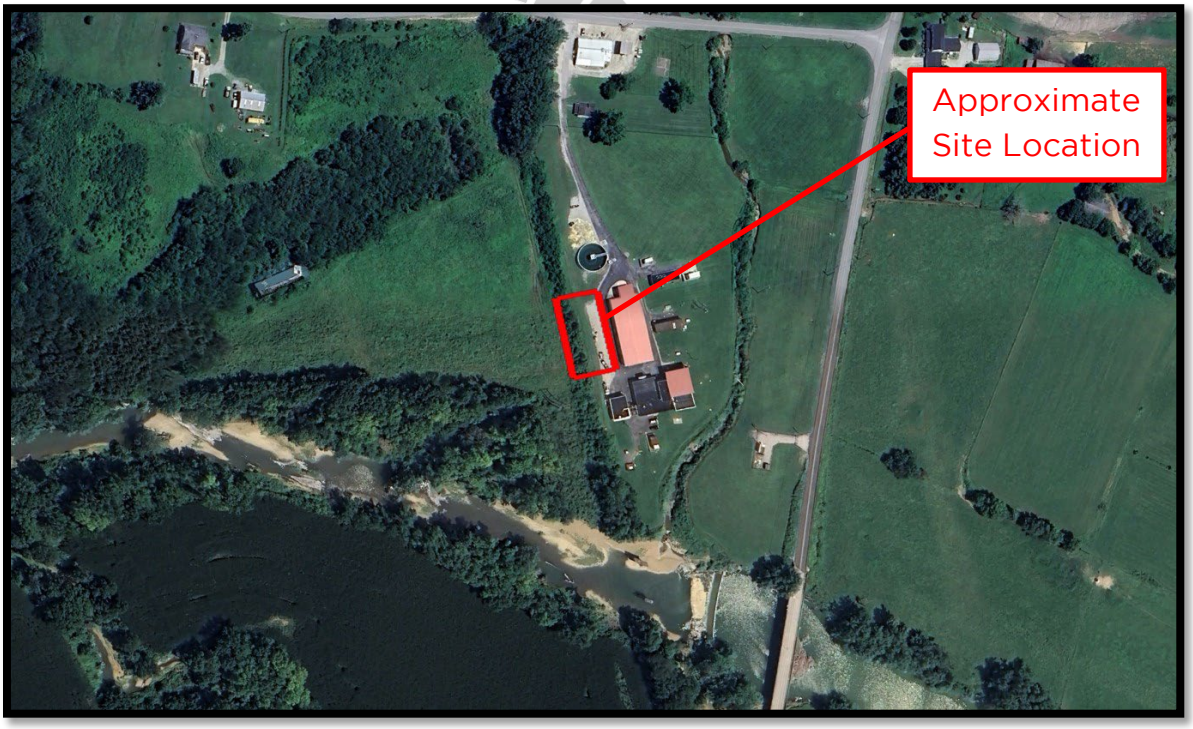


Figure 4: 2025 Google Earth Imagery

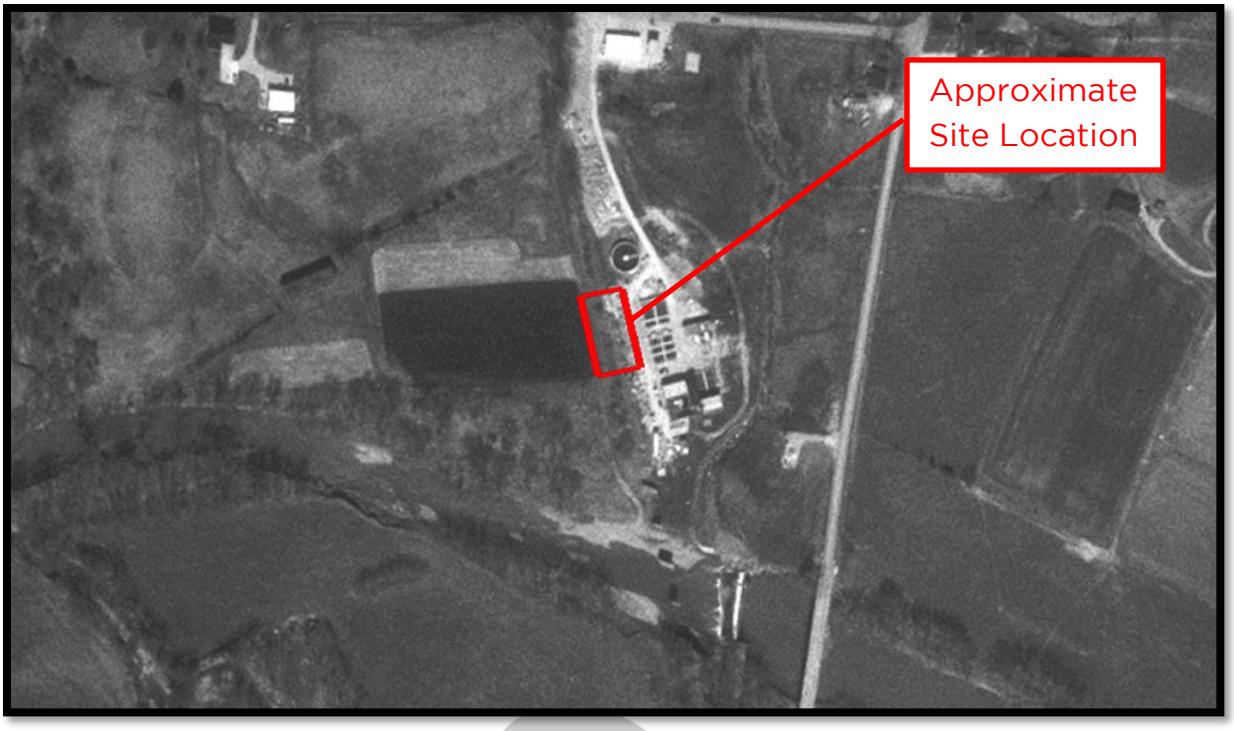


Figure 5: 1998 Google Earth Imagery

3.2 Published Geologic Information

Geologic information was referenced from the Kentucky Geological Survey (KGS), geologic maps of the Lebanon West Quadrangle, Marion County, Kentucky (Figure 6). The site is underlain by Alluvium, with outcroppings of the Boyle Dolomite and Drakes Formation mapped adjacent to the site. The Boyle Dolomite and Drakes Formation are believed to underly the alluvium at the site based off encountered bedrock and local stratigraphic columns. Locally, Alluvium is described as silt, clay, sand, and gravel, Quaternary in age. Locally, the Boyle Dolomite is described as limestone and dolomite, Middle to Upper Devonian in age. Locally, the Drakes Formation is described as dolomite, limestone, and minor shale.

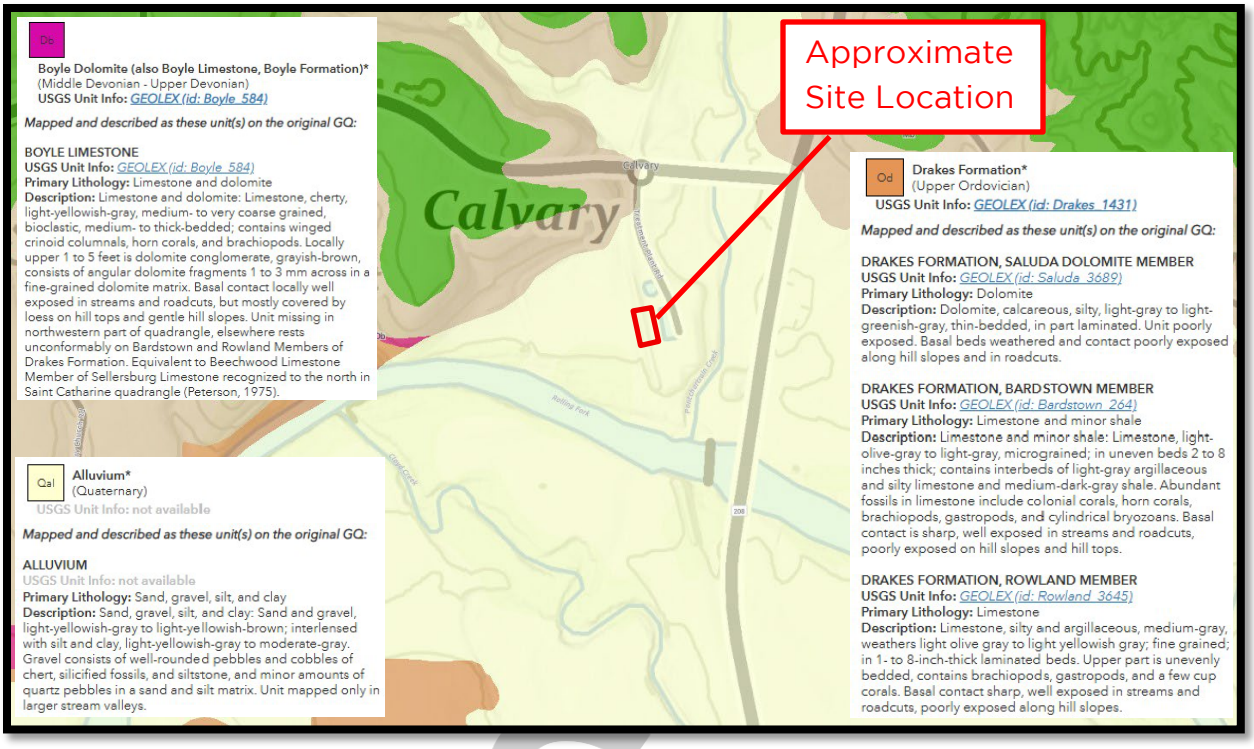


Figure 6: KGS Geologic Mapping

KGS mapping (Figures 6 and 7) indicates the site is mantled by alluvium, likely overlying the Drakes Formation and Boyle Dolomite. The KGS General Karst Potential map classifies the site area as non-karst, though KGS mapping indicates parts of the Drakes Formation are prone to karst due to the presence of limestone. Core samples from our borings recovered interbedded limestone, shale, and dolomite consistent with the Drakes Formation and Boyle Dolomite.

While widespread karst activity at the site is not indicated, isolated solution features beneath the alluvial cover cannot be ruled out. Although the site itself is classified as non-karst, the presence of mapped sinkholes within the Drakes Formation nearby indicates a localized risk. Isolated solution features beneath the alluvial cover should be anticipated, and mitigation methods such as over-excavation, inverted filters, or grouting may be required if encountered. If voids, raveling soils, loss of circulation, or unexpected grade loss are encountered during construction, contact Solid Ground for evaluation and remediation recommendations.

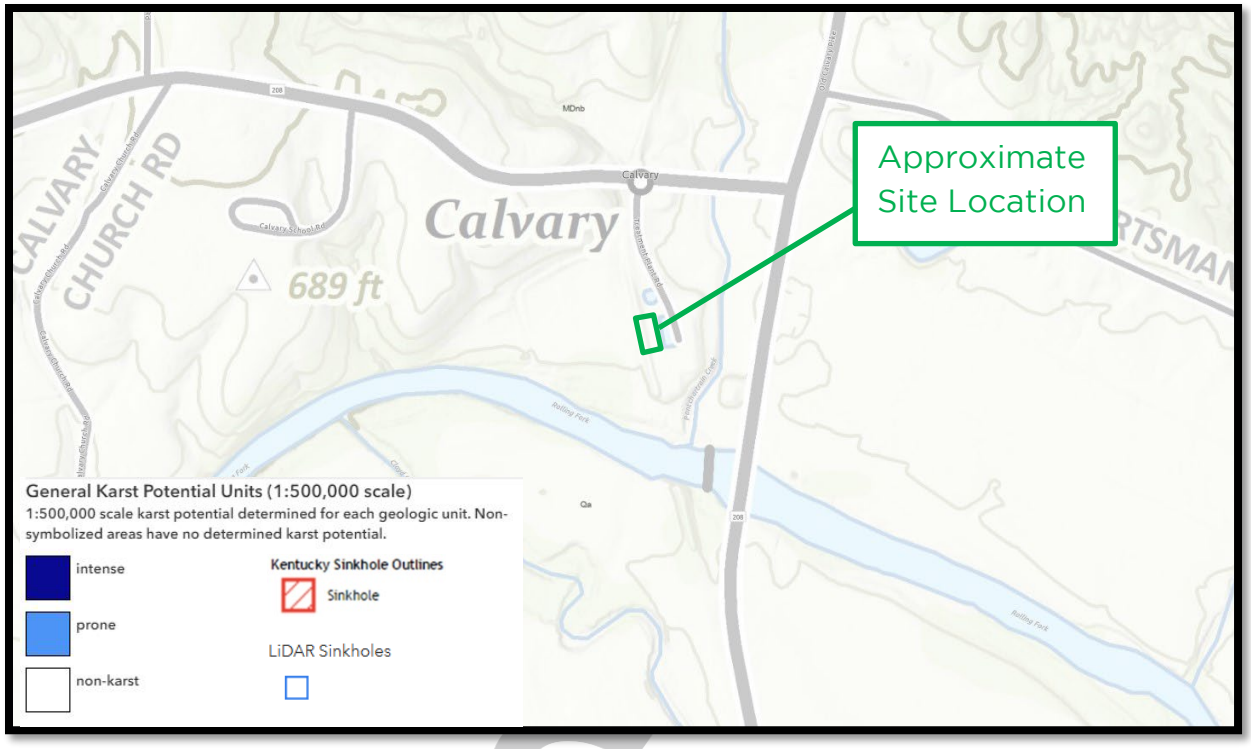


Figure 7: KGS Karst Potential Mapping

3.3 Subsurface Exploration Program

Solid Ground, along with Horn and Associates, conducted a total of six (6) soil test borings, all located within the approximate site location. One (1) of the soil borings was extended beyond auger refusal to perform rock coring. Borings were located as close to the proposed project as site conditions allowed.

Boring surface elevations were estimated using Carlson GPS Equipment. Therefore, the boring locations and surface elevations should be considered approximate. It should be noted that the subsurface conditions will vary between borings, and the representative profile is based upon the borings drilled during the field operations. Boring locations are shown in Figure 8 below.

Figure 8: Approximate Boring Locations

3.4 Subsurface Conditions

The soil samples were classified by Solid Ground personnel according to the Unified Soil Classification System (USCS ASTM D2488; USCS ASTM 2487 for select samples). A description of each soil layer is as follows.

Surficial Materials – The borings encountered a surficial layer of topsoil (3-15 inches) across the site. It should be noted that thicknesses of these materials may vary across the site. The thicknesses presented in this report should be considered approximate.

Fill and Natural Soils - The borings encountered fill and natural soils underlying the surficial materials layer described as Lean Clay (CL), Clayey Gravel (GC), Silty Clay (CL-ML), and Lean to Fat Clay (CL-CH) with varying amounts of sand, gravel, rock fragments, and silt to auger refusal depths.

The SPT N-values ranged from 3 to over 50 blows per foot, with a consistency of soft to hard/very dense.

Auger Refusal – All six (6) of the borings encountered auger refusal at depths from 8.7 to 21.3 feet. Auger refusal is not interpreted as bedrock for design purposes; confirmation of bedrock should be based on coring and excavation observations.

Bedrock – Boring B-6 had rock coring performed at auger refusal (see Table 1). B-6 encountered moderately weathered to fresh interbedded limestone, dolomite, and shale. The bedrock samples had recoveries of 89% to 100% and rock quality designations of 48% to 84%, indicating poor to good rock quality.

Groundwater – Groundwater was observed in B-6 at approximately 4.4 feet below ground surface at the time of drilling; groundwater levels may fluctuate seasonally and with river stage. Therefore, the borings may not be representative of the actual free water levels. To achieve an accurate measurement of free groundwater levels, water wells or piezometers should be installed.

Solid Ground should be contacted if groundwater is encountered during earthwork operations. Please note, the groundwater table can fluctuate significantly which could have an impact on the subsurface soils. Table 1 summarizes our findings.

Table 1: Boring Summary

Boring Number	Approximate Surface Elevation (ft)	Auger Refusal Depth (ft)	Auger Refusal Elevation (ft)	Total Coring Length (ft)
B-1	620.9	9.0	611.9	--
B-2	628.2	14.4	613.8	--
B-3	631.3	19.0	612.3	--
B-4	620.2	8.7	611.5	--
B-5	631.7	21.3	610.4	--
B-6	630.9	21.1	609.8	10.0

4.0 Geotechnical Concerns and Considerations

Based on the results of the subsurface exploration and experience with similar projects, we believe the project site is generally suitable for the proposed development. However, some concerns exist with the subsurface conditions as discussed below.

4.1 Surficial Materials

Based on the information gathered from the soil borings, the site has a surficial layer of topsoil (3-15 inches). These thicknesses are representative of conditions encountered at the boring locations only, thickness and aerial extent of the strata may vary across the site. Construction plans should adequately address stripping and the disposal of these materials prior to earthwork operations. Topsoil should only be used as fill in landscaping areas.

4.2 Construction in Cut/Fill Areas

Cut areas have the potential to be overcut, disturbing the in-situ soils to depths below proposed finished grade. Areas to receive fill are stripped of topsoil and are also sometimes disturbed to depths deeper than intended. Both cut and fill areas should be proof rolled prior to construction. Soft, loose, or wet areas should be identified and remediated in accordance with the recommendations provided in the “5.1 Earthwork” section of this report.

4.3 Construction During Wet Conditions

It is understood that potential development could occur during wet conditions. Based on experience with construction projects during wet conditions, subgrade remediation is often required. In addition, delays of earthwork/foundation operations could occur. Clays swell and silts break down when high moisture conditions are present. To stabilize the subgrade materials, drying and recompacting could be required. During wet conditions, the on-site materials may become saturated and are unable to dry in a timely manner. Temporary stabilization strategies such as lime treatment or scheduling work during dry periods should be considered.

Typically, remediation methods consist of undercutting soft and/or saturated soils, moisture conditioning, and recompacting or replacing with a granular stone that is “capped” with dense graded aggregate (DGA). The extent and depth of the undercut is on a case-by-case basis depending on the soil

conditions. We recommend contracting Solid Ground to observe earthwork operations and foundation and slab-on-grade construction. In addition, we recommend that the earthwork contractor and the design team adequately budget for remediation repairs.

4.4 Preliminary Liquefaction Potential and Settlement

This discussion represents a qualitative, screening-level evaluation only. No site-specific liquefaction analyses were performed. Liquefaction is the phenomenon where saturated soils develop high pore-water pressures during seismic shaking and lose their strength characteristics. This phenomenon generally occurs in areas of high seismicity where groundwater is shallow. Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow spread foundations.

Three conditions are generally required for liquefaction to occur:

1. The soil must be saturated (relatively shallow groundwater)
2. The soil must be loosely packed (low density)
3. Ground shaking of sufficient intensity must occur to function as a trigger mechanism.

Based on site geology, soil types encountered, and regional seismicity, the soils should be considered to have low liquefaction potential.

4.5 Site and Foundation Drainage

Experience has shown that the onsite materials are prone to degradation during wet periods of the year and/or under heavy traffic. Surface and ground water should be controlled while the subgrade fill materials are exposed and use only enough compactive effort to achieve stability and job site requirements for compaction. In addition, it is recommended that foundation concrete, or a concrete bearing medium, be placed the same day that foundation excavation is performed.

The final grade should be sloped away from the structure and pavements a minimum of two percent to promote positive drainage. Roof drains and foundation drains should be installed and should discharge surface runoff away from the structure to provide positive site drainage. It should be noted that drainage should be designed and constructed without impacting neighboring properties. Drainage design is beyond our scope of work.

It is imperative that dewatering be maintained during construction and after development. If positive dewatering methods are not continually applied and maintained, the potential of remedial subgrade measures and long-term settlement is greatly increased.

We anticipate that the primary concern and difficulty during construction will be properly dewatering the site. The contractor should observe the site and understand this report. Drainage measures should be maintained for the service life of the facility to prevent degradation of subgrade support.

4.6 Underground Utilities

Design and Construction plans should adequately address the concern of potential settlement of underground utilities. Please note, all excavations should adhere to applicable codes such as OSHA.

4.7 Soil Compaction Equipment

The soil compaction equipment should be selected by the type of fill anticipated for the site. We anticipate utilizing a sheepsfoot roller at this site for the on-site materials and a smooth drum roller for dense graded aggregate fill.

4.8 Off Site Borrow Material

It is anticipated that fill material may be required to achieve the FFE and proposed grading. Offsite borrow material could be required. Construction plans should include this consideration as well as ensure the offsite borrow material meets the recommendations detailed in this report.

4.9 Soil Plasticity

Some of the subsurface soils were classified as lean clay (CL) and lean to fat clay (CL-CH). These soils can have high plasticity characteristics and be subject to volume changes with fluctuations in moisture content. The near-surface soils exhibit low to moderate plasticity based on limited laboratory testing; localized higher-plasticity clay layers may be encountered. Care should still be taken to mitigate subgrade degradation and reduce subgrade remediation. Accordingly, mitigation measures may be required to limit subgrade degradation, including the following:

- Improved site drainage to minimize exposure of these soils to moisture fluctuations, especially near building foundations and slab on grade.
- Minimize exposure of these soils to excessive wetting or drying.
- Deepen soil supported footings past the seasonal moisture change zone.

4.10 Granular Material

Some of the on-site soils consisted of granular material (gravel, rock fragments, and sand). This material often does not allow "neat" excavations for foundations and utilities and will slump from the banks into the excavation. We anticipate that this will require additional backfill material and time to backfill. The contractor should account for this additional material and time during the pre-construction phase. If the gravel is to be reused as structural fill, it will likely require blending with the fine-grained soils to allow for proper compaction.

4.11 Silty Material

Some of the onsite soils are comprised of silty material which is prone to breaking down under high moisture and repeated traffic. Care should be taken to not allow water to pond on the site and to reduce the construction traffic across the building pad and paving areas.

4.12 Development within a Karst Region

Solution activity in areas underlain by limestone generally results from a slow process of dissolving the underlying rock units by surface runoff or rainwater. Sinkholes at the ground surface are caused from either a general raveling failure within the soil unit or by rock collapse. Either phenomenon typically results in depressions at the ground surface, which, if large enough, can be identified on topographic maps. In addition to the natural causes of sinkhole development previously discussed, sinkholes may form as a result from water leaking from subsurface piping and drainage systems such as buried water and sewer pipes, septic lateral fields, and roof drains beneath the building and floor slabs.

As previously stated, the Kentucky Geological Survey rates the site as not being prone to karst development, but underlying units cored included karst prone samples of interbedded limestone. It is not possible to remove all risk associated with construction over known sinkholes or in karst areas. Regional mapping indicates low karst potential; however, localized solution features

within limestone and dolomite units cannot be ruled out. The natural rising and lowering of the ground water table and surface water migration downward through the subsurface soils can create the risk of continued soil migration into solution voids in the underlying limestone.

There is potential for sinkholes to be encountered during construction, especially in cut areas and along the northern portion of the site. Solid Ground should be contacted if a solution feature or other karst feature is encountered during construction. Repair methods of sinkholes and other karst features exist. When sinkholes are encountered, the common practice is to excavate the soil from within the solution feature down to hard bedrock. The two most common methods of remediation are a concrete plug or an inverted filter.

We believe the risk with this development is no greater than for similar developments in the area. To further reduce the risk of unidentified sinkholes at the site would require the implementation of more sophisticated and expensive geotechnical exploration methods including borings or test pits on a tightly spaced grid or geophysical methods.

4.13 Flood Zone

Most of the site is located within Zone A, the 1-percent annual chance (100-year) Special Flood Hazard Area. A narrow strip corresponding to the upper elevation (crest) of the former railroad berm lies outside of Zone A. The finished floor elevation (FFE) of the facility/GAC vessels is approximately comparable to the elevation of this upper berm. In contrast, the FFEs of the GAC pump room and chemical feed room are well below the anticipated floodplain elevation. Additional measures such as incorporating floodproofing or coordinating with FEMA/local floodplain authorities should be considered. This issue may also impact permitting and insurability. Base Flood Elevations (BFE) and floodway limits should be confirmed using the effective FEMA Flood Insurance Rate Map (FIRM) and coordinated with the local floodplain administrator. Structures or rooms with finished floor elevations below the Base Flood Elevation should be evaluated for buoyancy, hydrostatic pressures, and floodproofing requirements.

4.14 Temporary Shoring of Excavation

We anticipate that temporary shoring and or cofferdams may be required for the construction of the proposed facility. Groundwater will likely be a concern

for excavations due to the proximity of the Rolling Fork River to the proposed facility. If a sloped or benched excavation is utilized, the excavation should comply with local, state, and federal safety regulations including the OSHA excavation safety standard under OSHA 1926 Subpart P. The shoring system may need to be substantial due to the excavation depth, potential groundwater influence, and potential surcharge loading from construction equipment. Construction plans should explicitly address these considerations, and it is strongly recommended that the structural engineer, specialty structural engineer, or contractor design a system that accommodates these conditions.

Earthwork contractors should be aware that vertical and near-vertical cuts in granular soils are prone to raveling and may experience significant caving failures under unfavorable conditions. Appropriate precautions should be taken to shore the excavation to ensure safety and stability. All shoring and bracing systems should comply with applicable local, state, and federal safety regulations, including OSHA excavation and trench safety standards under OSHA 1926 Subpart P. The design and construction of temporary or permanent shoring or dewatering systems is the responsibility of the contractor and is beyond the scope of this geotechnical exploration. Construction plans should also address the potential for undermining existing structures, roadways, and hardscapes adjacent to the site. Solid Ground is available to provide a competent person to evaluate temporary and permanent slopes in the field, as required.

4.15 Excavation Bottom Heave

The excavation for the proposed facility poses potential concerns for bottom heave, since there is a potential for the excavation to be dewatered. The soil may experience upward pressure from the underlying groundwater and stress redistribution during dewatering, leading to heave. The extent of heave will depend on the permeability and stiffness of the soils, as well as the depth of the excavation and the efficiency of the dewatering system. To mitigate this risk, a detailed analysis of the excavation, shoring, and dewatering systems is recommended. Construction sequencing and stabilization measures, such as temporary over-excavation with structural backfill or ground improvement techniques, may also be required to control heave and maintain the stability of the excavation.

4.16 Uplift Considerations

The proposed structures should be evaluated for potential uplift forces resulting from buoyancy due to the potential presence of groundwater from the proximity of the site to the river. There is potential for groundwater elevations to vary significantly with the river elevations. Floodwaters are also a concern due to the structure FFE's sitting within the Zone A Special Flood Hazard Area. Given that groundwater levels may fluctuate seasonally or due to site-specific hydrogeological conditions, the design should ensure that the structure's weight, combined with any soil overburden and anchoring measures, adequately counteracts the potential uplift forces. The use of a heavier bottom slab, additional ballast, or anchoring systems should be considered to mitigate the risk of flotation. Site-specific hydrostatic pressures should be calculated to verify stability under the most critical groundwater conditions. Monitoring wells or piezometers can be installed to gather groundwater data to assist in design.

4.17 Bedrock Excavation

Bedrock was encountered in the vicinity of the proposed GAC pump and chemical feed rooms at a depth of approximately 21.1 feet below existing ground surface. The existing ground elevation at this location is approximately 630.9 feet, while the proposed finished floor elevation (FFE) of the GAC pump room is approximately 588.67 feet. These elevations indicate that a substantial thickness of rock excavation (on the order of approximately 20 to 22 feet) will likely be required to achieve design subgrade for the pump room.

Rock excavation is anticipated to include removal of competent bedrock as well as boulders and cobbles. Excavation in confined areas will likely require heavy ripping equipment, hoe-rams, and/or pneumatic hammers. Depending on rock hardness, degree of fracturing, and orientation of bedding and discontinuities, controlled blasting may be required.

If blasting is proposed, the contractor should evaluate the proximity of adjacent structures, utilities, and infrastructure and implement appropriate blast control, vibration monitoring, and protective measures to minimize the potential for damage.

Construction plans and bid documents should account for the anticipated extent of rock excavation and clearly define acceptable methods of removal,

handling, and disposal or reuse of excavated material. Contractors should anticipate slower production rates for rock excavation compared to soil excavation and include appropriate allowances in scheduling and cost estimates.

Solid Ground should be contacted to review final excavation grades and foundation elevations so that recommendations can be verified and refined as necessary.

4.18 Mass Fill Placement

Based off the provided grading plans and elevation change on the east side of the berm, mass fill placement of up to 10 feet is anticipated. Mass fill placement will drastically increase the settlement potential of the in-situ soil below the fill as well as the placed fill. Immediate settlement due to fill placement is anticipated to be relatively small (on the order of approximately 1 inch), but Long-term settlement may be significant where thick fills are placed over compressible soils; settlement magnitude will depend on fill thickness and subsurface conditions. We recommend wick drains and settlement monitoring stations be placed within fills greater than 10 feet. Wick drains will help speed up the consolidation of the soil and reduce the time required for long-term settlement. Surcharging the fill is also recommended in conjunction with wick drains to further speed up consolidation, if necessary to meet the project schedule. Once more of the project is designed, Solid Ground can assist with wick drain implementation.

Where fill is placed against existing slopes, the existing ground surface should be benched (terraced) into competent native soils prior to fill placement to reduce the potential for slippage and to promote bonding between the existing soils and new fill. Structural fill should be placed in thin, uniform lifts (generally not exceeding 8 to 12 inches loose thickness) and compacted to the specified density. Fill placement should proceed from the lowest elevation upward, and compaction testing should be performed on each lift to verify compliance.

4.19 Previously Placed Undocumented Fill

As previously mentioned, fill material was encountered within the borings. This fill material is likely associated with historical construction of the railroad embankment, where imported soils and rock were likely used to build up and support the rail alignment across the site. Uncontrolled fills often contain deleterious or miscellaneous materials which may consolidate over time, causing subsidence at the surface. If the structure is founded on footings and/or slab on grade bearing within the uncontrolled fill material, there is a risk that foundation and/or slab settlement may occur. This could potentially cause differential settlement of the footings or cracking in the floor slab of the building. Those risks are discussed in the foundation and grade supported slab sections of this report. The owner should understand and accept the risk of bearing on uncontrolled fill placed without quality control.

4.20 Deleterious Materials (Coal Remnants)

Coal fragments were observed in some of the soil samples recovered during the subsurface exploration. Since coal is not naturally occurring in this area, these materials are likely associated with historical railroad activity spanning through the site. Coal is considered a deleterious material due to its soft, brittle nature and tendency to deteriorate under loading and weathering, which can result in loss of bearing capacity and localized settlement over time.

Any soils containing coal fragments encountered during earthwork operations should be removed from foundation and pavement subgrades and replaced with engineered structural fill in accordance with Section 5.1 of this report.

5.0 Confirmation-Dependent Recommendations

The following recommendations are based on the information gathered and subsurface conditions encountered during this limited exploration. We have developed these recommendations under the assumption that our sampling performed on the site accurately portrays conditions that are not immediately visible due to earth, rock, water, or time. It should be noted that Solid Ground cannot be held responsible for fill placement or subgrade performance without observation to confirm that conditions in the field are consistent with inferences from the samples we obtained. **It is recommended to retain Solid Ground to observe proof rolling of the building pads and pavement areas, prior to and during fill placement.**

It is recommended to retain Solid Ground to perform construction materials testing and special inspection for the duration of construction to both maintain speed of construction and overall project costs. Please note, if earthwork construction begins during wet weather conditions there is a possibility that the schedule will be prolonged and extensive remediation, or a more robust geotechnical recommendation will be required.

5.1 Earthwork

5.1.1 Site Preparation

- Topsoil and other surficial materials should be stripped to prepare the site for construction.
    - In-place density testing should be performed to check that the previously recommended compaction criteria have been achieved.
    - Fill placement should be monitored on a full-time basis by Solid Ground during site grading.
    - Fill placement should extend to a minimum of 10 feet beyond the building footprint.
- After stripping and cutting operations, the subgrade should be evaluated by Solid Ground.
- The building pad may require stabilization prior to new fill placement or slab-on-grade construction. Solid Ground should be consulted to assist in selecting the most appropriate method for site conditions. These methods may consist of any or combination of the following:
    - Tensar geogrid reinforcement.
    - “Walking” No. 2 stone into the soft subgrade.

- Application of compacted DGA.

5.1.2 Structural Fill Placement

The preliminary FFE of the GAC facility is currently set at 628.0 feet. The GAC pump room has a preliminary FFE of 588.67 feet, and the chemical feed room has a preliminary FFE of 606.67 feet. We anticipate moderate to significant site grading and the addition of 8-10 feet of engineered fill will be required to achieve finished grade. Backfill materials for structural fill placement may consist of soil or durable crushed stone. The following steps are recommended for fill placement within the building pads. **Select onsite soils are expected to meet the requirements of structural fill subject to observation and testing. Offsite borrow material may be necessary to achieve finished grade but cannot be ruled out without a review of the final site grading plans. Any soils containing deleterious materials should not be utilized as structural fill.**

Structural fill material is defined as the following:

- Inorganic natural soil with maximum particle sizes of 3 inches.
- Liquid Limit no greater than 50 percent and Plasticity Index no greater than 30 percent.
- Fill should be virtually free of organic material.
- Solid Ground should observe the material to confirm the soils meet applicable standards for structural fill.
- Other sources of structural fill should be verified by Solid Ground.
    - If other sources of structural fill are anticipated, Solid Ground should collect a bulk sample for Standard Proctor testing.

The following are recommendations for placement of soil structural fill:

- Structural fill should be placed in no greater than 8-inch-thick layers.
- Structural fill should be compacted to at least 98 percent of the soil's maximum dry density as determined by the Standard Proctor Compaction test (ASTM D698).
- The moisture content of the fill material should be maintained within 2 percent (above or below) of its Standard Proctor optimum moisture content depending on the results of the Proctor tests.
- In-place density testing should be performed to check that the previously recommended compaction criteria have been achieved.

- Fill placement should be monitored on a full-time basis during site grading.
- Fill placement should extend to a minimum of 10 feet beyond the building footprints.

5.1.3 Protection of Earthwork

Common earthwork construction practices can leave soils exposed for long periods of time while work is performed in other areas of a site. Care should be taken during the earthwork phase to protect soils from degradation caused by sunlight, wind, precipitation, and other factors. Solid Ground recommends that any exposed soil be protected by straw, seeding, rock, or other methods if the area the soil is in will be left unattended for more than three days. Any soil left unattended or unprotected for more than three days should be re-evaluated prior to continuation of work.

5.2 Foundations

5.2.1 Discussion

Foundation selection should consider anticipated fill thickness, groundwater conditions, and structural loading. Deep foundations are recommended where thick new fill or compressible soils are present. Shallow foundations or mat foundations may be considered where foundations bear directly on competent bedrock.

Given the anticipated heavy equipment loads and the presence of soft to low consistency alluvial and clayey soils over bedrock at depth, we recommend supporting the proposed tanks and structure footings on deep foundations that bear in competent bedrock. Two systems are suitable for this site: grouted micropiles or drilled shafts with rock sockets. Either system can be designed to resist the required vertical loads as well as lateral and seismic demands. The final selection can be made during design after considering access, contractor means and methods, schedule, and cost. Foundations for the tanks and structure footings should be structurally isolated from adjacent slabs or other elements on shallow foundations to limit differential settlement, and isolation joints should be provided so shallow founded elements can move independently. Final element sizing, tip elevations, and verification testing will be established after confirmation of bedrock quality. Due to the anticipated FFE of the lower pump rooms, we anticipate the lower pump rooms can utilize

mat foundations bearing directly on bedrock. Please note mat foundations may require uplift anchors or significant ballast to resist buoyancy from hydrostatic pressures. Final foundation selection and design parameters should be confirmed based on final structural loads and construction sequencing.

5.2.1.1 Micropiles

Micropiles are a deep foundation element constructed using high-strength, small diameter steel casing and/or threaded bars. The micropile casing generally has a diameter in the range of 3 to 10 inches. Typically, the casing is advanced to the design depth utilizing a duplex drilling technique where the casing and drill rod inside the casing are advanced simultaneously. The casing may extend the full depth or end above the bond zone with the reinforcing bar(s) extending to the full depth or several feet into the bottom of the casing.

- Micropiles utilize a steel pile cap that is cast into the concrete foundation.
- We do anticipate some false shallow refusal during installation. The micropiles should be designed to be cased through the overburden and fill.
- Micropile design should be verified through a testing program that includes verification and proof testing performed in accordance with the design engineer and manufacturer's recommendations as well as per the building code requirements.
- Micropile design should include analysis of the casing joints in situations where a bending moment and/or shear force is applied across the casing joint.
- Micropile design should consider any potential down drag forces exerted on the micropile due to settlement of the soils surrounding the micropile.

We recommend using a preliminary **ultimate grout-to-ground bond strength of 50 psi** for the micropile bond zone in competent limestone with interbedded dolomite and shale. Allowable bond stress shall be established by the design engineer using an appropriate factor of safety and confirmed by verification testing. The micropile casing should extend a minimum of 2 feet (plunge depth) into competent rock and the bond may start at the bottom of the micropile casing. Each micropile should have a minimum bond length of 5 feet in competent bedrock below the casing plunge depth. Actual bond lengths will be determined during the micropile design.

Micropile testing should be observed, and test results should be approved by the Geotechnical Engineer of Record. A detailed settlement analysis was

beyond the scope of this report. Micropiles are anticipated to exhibit minimal immediate and long-term settlement, typically less than 0.5 inches, subject to final design and verification testing. Once the design is finalized, we recommend allowing us to review the plans and specifications.

Table 2 – Generalized Micropile Design Parameters for Competent Bedrock

Bedrock Description	Preliminary Ultimate Bond Strength, PSI	Minimum Casing Plunge Depth (ft)	Minimum Bond Length in Bedrock (ft)
Interbedded Limestone, and Dolomite	50	2	5

Spacing Requirements

Due to the potential for Karst geology and potential fractured bedrock, we recommend a minimum center-to-center pile spacing of 30 inches or 3 pile diameters, whichever is larger. This restriction is necessary to limit group effects and damage to adjacent micropiles.

Quality Control Requirements

Each micropile installation should be observed by the Geotechnical Engineer of Record to ensure the design bond length is established in competent bedrock. The number of micropile verification tests should vary with the size of the area being supported with micropiles, varying diameters of micropiles, and changes in drilling methods. Verification test results should be sent to the Geotechnical Engineer of Record for approval. Once verification tests are approved, a certain percentage (typically 5 percent) of the production micropiles should be proof tested. Solid Ground personnel performing inspections can determine in the field if the micropile is bonded in the appropriate material or if the micropile needs to be installed deeper.

We recommend that the micropile construction be observed by Solid Ground. The observation should address the following items:

- Correct plan dimensions
- Plumbness within tolerances

- Materials excavated agree with borings
- Verification of bond zone material
- Construction procedure

Discussion with Design Team for Micropiles

Due to the variable loading and structure information for this site we recommend that the structural engineer work with the micropile design engineer to develop the micropile and pile cap design as the optimization of both designs are dependent on each other and could have cost savings to the owner.

5.2.1.2 Drilled Shafts

We recommend using a maximum net allowable **competent bedrock** bearing pressure of **30,000 PSF** (pounds per square foot) for foundations utilizing drilled shafts. Any capacity from the soil overburden should be neglected for drilled shafts. Competent bedrock can be used for end bearing, provided the appropriate net allowable bearing capacity. Each drilled shaft should have a minimum rock socket depth of 1D (D being the Diameter of the Drilled Shaft). We recommend that a 5-foot test hole or rock core be observed at each shaft once bottom of shaft elevation is achieved.

This allowable bearing pressure assumes that the bearing material for each drilled shaft will be observed and approved by the geotechnical engineer of record. A net allowable skin friction of 2,500 PSF is available for rock socket capacity considerations.

Competent bedrock is defined as slightly weathered or better interbedded limestone. dolomite, and shale bedrock, a RQD (rock quality designation) of 65% or better, and with no fractures in excess of 6 inches. Competent bedrock should be verified by the Geotechnical Engineer during foundation placement.

Total and differential settlements of foundations bearing on continuous interbedded limestone and dolomite, using the recommended bearing pressure, should be about 1/2 inch or less. Once the design is finalized, we recommend allowing us to review the plans and specifications.

Table 3 – Generalized Design Parameters for Competent Bedrock

Bedrock Description	Net Allowable Skin Friction, PSF	Net Allowable Uplift Skin Friction, PSF	Net Allowable Bearing Capacity, PSF	Lateral Bearing Capacity, PSF/ft
Interbedded Limestone and Dolomite	2,500	1500	30,000	600

Drilled Shaft Construction Considerations

Given that drilled shafts are anticipated to bear upon limestone with interbedded dolomite and shale bedrock, the drilled shafts should be placed the same day that they are open or no later than 12 hours after opening. If the rock socket of the shafts appears to be degraded within the first 12 hours after opening, an additional 1 vertical foot of over-excavation will be required. It is imperative to excavate, and place concrete the same day to ensure the bearing is protected from wet weather that could potentially cause degradation of the bedrock.

Construction Considerations (Dry Method)

- Clean the foundation bearing area so it is nearly level or suitably benched and is free of ponded water or loose material.
- Provide a minimum drilled shaft diameter of 30 inches for cleaning, bottom preparation, and inspection. If the drilled shaft is less than 36 inches an air test hole can be performed either with an air track rig or by coring to observe the end bearing conditions at each drilled shaft.
- Make provisions for ground water removal from the drilled shaft excavation. Ground water conditions at this site will require the use of special procedures to achieve a satisfactory foundation installation.
    - If water is flowing into the drilled shaft at less than 20 gallons per minute, pumps may be used to maintain less than 2 inches of water in the drilled shaft during cleaning and inspection.

After approval of the bearing surface, the pumps should be pulled, and concreting commenced immediately.

- If more than 20 gallons per minute are flowing into the drilled hole, the water level should be allowed to stabilize before attempting to place the concrete. For this condition, concrete placement should be accomplished using a tremie pipe or concrete pumping equipment.

- Specify concrete slumps ranging from 4 to 7 inches for the drilled shaft construction.
- Retain Solid Ground to observe foundation excavations after the bottom of the hole is leveled, cleaned of any mud, and dewatered.
- Install a temporary protective steel casing to prevent side wall collapse, prevent excessive mud and water intrusion, and to allow workers to safely clean and inspect the drilled shaft.
- Clean the socket "face" prior to concrete placements. Cleaning will require washing if a mud smear forms on the face of the rock. Solid Ground should approve the rock socket surface prior to concrete placement.
- The protective steel casing may be extracted as the concrete is placed provided a sufficient head of concrete is maintained inside the steel casing to prevent soil or water intrusion into the newly placed concrete.
- Direct the concrete placement into the drilled hole through a centering chute to reduce side flow or segregation.
- Solid Ground recommends a 15 percent concrete overage allowance for seams and cracks in surrounding bedrock.

Construction Considerations (Slurry Method)

- Provide a temporary steel casing to prevent side wall collapse, above the ground water level.
- Prior to drilling, install the temporary steel casing to a minimum depth of 10 feet below the expected ground water level using driving techniques.
- Use a bentonite slurry suspension to support the uncased portion of the drilled shaft.
- Circulate or agitate the bentonite slurry to prevent silt- and sand-sized particles from settling of the suspension prior to concreting.
- Pump or tremie the concrete to the bottom of the driller shaft. If a tremie is used, place a plug in the tremie pipe to reduce exposure of the concrete to water.
- Use a concrete mix with a design slump of 5 to 7 inches for drilled shaft concrete.
- Extract the temporary steel casing as the concrete is placed. Maintain a positive head of concrete above the casing bottom as the casing is extracted.
- The protective steel casing may be extracted as the concrete is placed provided a sufficient head of concrete is maintained inside the steel casing to prevent soil or water intrusion into the newly placed concrete.
- Overfill the drilled shaft with concrete to aid in wasting drilled shaft concrete contaminated by exposure to the slurry solution and suspended sediment. We recommend that project planning include a minimum of 15 percent concrete waste. The actual quantity of contaminated concrete removed from the drilled shaft should be governed by site observations of the geotechnical engineer monitoring the drilled shaft installation.
- Solid Ground recommends a 15 percent concrete overage allowance for seams and cracks in surrounding bedrock.

Rock Excavation

Our borings encountered varying depth to refusal. Our experience with the underlying bedrock formation indicates the rock will be slightly to moderately weathered. Typically, an average depth of rock removal of 1/4 to 1 shaft diameters should be anticipated to provide a level bottom and rock suitable to achieve the allowable bearing pressure. In some cases, the depth of rock removal may extend.

Our experience indicates general drilled shaft construction and delineation of "rock" in the excavation is greatly facilitated if suitable drilling equipment is used. We recommend the use of a drill capable of producing at least 500,000-inch pounds of torque and 35,000 pounds of downward force. Additionally, we recommend that rock be defined as material which cannot be penetrated by a heavy-duty earth auger with hardened teeth at a rate in excess of 6 inches per minute.

Quality Control Requirements

Each drilled shaft should be excavated to appropriate bearing medium as outlined in this section and be inspected by Solid Ground. We recommend that all drilled shaft locations have probe holes performed to remove the need for costly and time-consuming down hole inspections. **We do not recommend downhole inspections**. Solid Ground personnel performing inspections can determine in the field if the shaft is on appropriate bearing material or if the shaft needs to be excavated deeper. The geotechnical engineer will evaluate the condition of the bearing material.

We recommend that the drilled shaft construction be observed by Solid Ground. The observation should address the following items:

- Correct plan dimensions
- Plumbness within tolerances
- Materials excavated agree with borings
- Statement of bottom cleanliness
- Construction procedure

5.2.1.3 GAC Pump and Chemical Feed Room Mat Foundations

Based on the subsurface conditions encountered, information gathered during this exploration, and past knowledge of the site's development, we recommend that the lower pump room foundations be designed as mat

style slabs bearing on bedrock. If bedrock is not at the bottom of slab elevation, flowable fill can be utilized from the bedrock surface up to the bottom of slab elevation. As previously mentioned, uplift anchors and/or additional ballast may be required to resist buoyancy forces from hydrostatic pressures.

We recommend the use of a maximum net allowable bearing pressure of 5,000 PSF (pounds per square foot) for foundations bearing on these materials.

A detailed settlement analysis was beyond the scope of this report. Based on the assumed structural loads, the available site grading information, the recommended bearing pressure, knowledge of the site's development and empirical correlation for the subsurface conditions encountered beneath the proposed structure, we estimate the total settlement of the foundation to be about 1/2 inch or less and differential settlement of the foundation to be about 1/4 inch or less.

Once the design is finalized, we recommend allowing Solid Ground the opportunity to review the plans and specifications.

5.3 Slab-on-Grade

We assume that the slab on grade will be utilized for loads with 150 pounds per square foot maximum. If this assumption is incorrect, Solid Ground should be contacted to modify recommendations.

- It should be noted that if the site soils are exposed to wet weather conditions or continuous construction traffic, the soils have potential to degrade and will lose their strength. This could require a more robust subgrade improvement design.
- It is imperative that dewatering be continuous and construction traffic be controlled away from the building pad.
- It should be noted that the means and methods of construction that will be performed by others will heavily dictate the suitability and sustainability of the site conditions and building service life during and after construction.

The following recommendations should be followed:

- Solid Ground should observe the finished subgrade utilizing proof rolling once grading is completed. If excessive pumping and/or rutting is observed remediation may be required. Typical remediation methods consist of undercutting the unsuitable soil and placing recompacted soil or granular material.
- If construction is to take place during wet periods of the year, there is a potential that remediation methods will be required to stabilize the soil subgrade. Solid Ground should be consulted to assist in selecting the most appropriate method for site conditions. These methods may consist of any or combination of the following:
    - Tensar geogrid reinforcement.
    - "Walking" No. 2 stone into the soft subgrade.
    - Application of compacted DGA.
- It is imperative that quality control be performed specifically for the slab on grade to ensure that moisture contents, as well as compaction efforts, are within optimum.
- It is recommended that the floor slab be constructed with an open graded stone base of a minimum of **6 inches** in thickness. The floor slab should be constructed with a minimum of **4 inches** of reinforced concrete.
- A subgrade modulus, *k,* of 70 pounds per cubic inch (pci) for design of the floor slab supported by granular material.
- Control joints should be placed per the most recent ACI standards and guidance.
- The floor slab should be fully ground-supported. This will reduce the possibility of cracking and displacement of the floor slab due to differential settlement.
- Slabs should be isolated from deep foundation elements to limit the transfer of differential movements.

It is recommended to perform proof rolling prior to placing stone to serve as the slab working base, and again immediately prior to constructing the slab.

5.4 Seismic Site Classification

The Seismic Site Classification assumes shallow soil bearing mat foundations will be utilized. This classification is based on the seismic standards and design values from the 2009 NEHRP Recommended Seismic Provisions and the 2010

ASCE-7 Standard. Based on the results of our exploration and the geology of the area, we assign a site seismic classification of "D".

5.5 Below Grade Walls

Based on our understanding of the project, below grade walls may be required for this development. The potential for groundwater may make it necessary to consider hydrostatic pressure in the wall design, as undrained conditions may not be able to be avoided. The following recommendations provide guidance for the design of below grade walls under drained conditions, but the wall system should also account for hydrostatic pressures under fluctuating groundwater levels.

Hydrostatic and Earth Pressure Design

The following table (Table 4) presents equivalent fluid pressure (EFP) values for at-rest, active, and passive conditions for typical backfill materials. For undrained conditions, hydrostatic pressure should be combined with these EFP values in the wall design. Additionally, surcharge loads generated by construction equipment, adjacent structures, and infrastructure should be considered, and a factor of safety should be incorporated into the design. These factors are not addressed in this report and should be determined by the structural engineer of record. Below-grade walls should be designed for full hydrostatic pressure unless permanent drainage systems are provided and maintained.

Table 4 – Equivalent Fluid Pressures

Backfill Material	At Rest (PCF) Drained Condition	Active (PCF) Drained Condition	Passive (PCF) Drained Condition
Anticipated Well Graded Gravel sloping towards the wall (Φ = 38◦)	50	30	600
Anticipated clayey soil sloping towards the wall (Φ = 22◦)	75	55	260

Foundation support and Sliding Resistance

It is assumed the retaining walls will be supported by mat foundations bearing on bedrock or deep foundations. Below grade wall foundations should utilize the foundation recommendations outlined in Section 5.2. To resist sliding, a coefficient of friction of 0.35 between bedrock and concrete may be used.

Design Considerations

Given the potential inability to drain water from behind the walls, the structure design should consider hydrostatic uplift and lateral hydrostatic pressures. The design should include the following considerations:

- **Hydrostatic Pressure**: Account for the groundwater height relative to the bottom of the structure.
- **Structural Reinforcement**: Provide sufficient wall reinforcement to resist combined earth and hydrostatic loads.
- **Bottom Slab**: The bottom slab should be designed to counteract buoyancy forces due to groundwater uplift.
- **Waterproofing**: The walls and slab should be constructed of watertight concrete or treated with appropriate waterproofing systems to ensure durability under constant submersion.

Temporary shoring and dewatering systems will be critical during construction to maintain excavation stability and manage groundwater intrusion. The design of these systems should account for the significant hydrostatic pressures and seepage forces that will occur during excavation. Construction sequencing should be planned to minimize the time the excavation is exposed to groundwater.

5.6 Plan Review

To better ensure confirmation of the final design documents with the recommendations contained in this report, and to better comply with the building department's requirements, Solid Ground should review the completed project plans prior to construction. The plans should be made available for our review as soon as possible after completion so that we can better assist in keeping your project schedule on track.

We recommend that the following project-specific note be added to the architectural, structural, and civil plans: "The geotechnical aspects of the project, including site grading, utility and foundation excavations, slab on grade construction, placement and compaction of engineered fill, installation of site drainage should be performed in accordance with the recommendations of the *"Geotechnical Report prepared by Solid Ground Consulting Engineers, dated February 20, 2026."*

5.7 Construction Monitoring and Observations

Based on experience, in order to obtain the Certificate of Occupancy for this development, you will be required to directly contract a qualified and certified inspection firm to provide special inspection items consisting of observing the following:

- Soil Fill Placement
- Foundation Construction
- Concrete Placement
- Reinforcement Placement
- Masonry Construction
- Steel Construction

It is advantageous to the owner to contract with Solid Ground to provide construction monitoring and observations for this project. Some of those benefits are as follows:

- As the Geotechnical Engineer of Record (GEoR) for this project, we will provide confirmation that subsurface conditions exposed during construction are substantially the same as those interpolated from our limited subsurface exploration, on which the analysis and design were based.
- The recommendations in this report are based on limited subsurface information. The nature and extent of variation across the site may not become evident until construction. If variations are then exposed, it will be necessary to re-evaluate our recommendations. If subsurface conditions differ from those anticipated, we as the GEoR will provide recommendations if deemed necessary.

6.0 Report Limitations

This report has been prepared for the exclusive use of the *Kentucky Engineering Group, PLLC and Mr. Ryan Carr* for specific application to the project site. Our recommendations have been prepared using generally accepted standards of geotechnical engineering practice in the Commonwealth of Kentucky. No other warranty is expressed or implied.

The recommendations provided are based on the subsurface information and other findings obtained by Solid Ground as well as the information provided by you. If there are revisions to the plans for this project or if subsurface conditions detailed in this report are encountered during construction that are different than our exploration, we should be notified immediately to modify the foundation recommendations if deemed necessary. We cannot be held responsible for the impact of those conditions on the project if those impacts are not made known to us.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. This report does not address construction means and methods, contractor safety procedures, or temporary works.

7.0 Associated Geotechnical Risks

The analytical tools which are used by the geotechnical engineer in this area are generally empirical and must be used in conjunction with professional engineering judgment and experience. Therefore, the recommendations presented in this geotechnical exploration should not be considered risk-free and are not a guarantee that the proposed structure will perform as planned. The engineering recommendations presented in this are based on the information gathered during the subsurface exploration, information provided by you and experience with similar projects.

APPENDICES

APPENDIX A – BORING LOGS

APPENDIX B – LAB RESULTS

Soil Boring: B-1

SOLID GROUND
CONSULTING ENGINEERS

Project: Lebanon WTP GAC Facility
Location: Lebanon, KY
Project Number: 26-121

Date Started: 01/23/2026	Date Completed: 01/23/2026	Coordinates: 37.514012, -85.262550
Location Accuracy: Estimated from Google Maps	Client Name: Kentucky Engineering Group, PLLC	Hammer Type: Auto
Method: Auger	Depth: 9'	

Rig Type: Mobile B-25
Tooling: 3-1/4" Hollow Stem Auger
Surface Elevation: 620.9'

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	Samples: Depth of Sample (ft)	Samples: Sample Graphic	Samples: Blow Counts	Samples: Uncorrected N-Value	Lab: Moisture Content (%)
	620		**Topsoil** 1.3	0 ft		2-4-3	7	29.4
			Lean Clay, firm, moist, grayish brown, red mottling, trace chert, trace glass fragments (CL) 2.5	2.5 ft				
			Silty Clay, stiff to very stiff, moist, light brown, trace organics (CL-ML) 5	5 ft		5-7-8	15	
5								
	615		**Lean to Fat Clay**, very stiff, moist, grayish brown, orange mottling (CL-CH)			5-7-12	19	21.9
			7.5': brown, little gravel, wet, hard 9	7.5 ft		4-3-50/0.4'	53	54.9

Auger refusal at 9'

Graphics Legend

- Topsoil
- CL-CH
- CL
- CL-ML
- SS - Small Split Spoon

Water Levels

- ▽ -
- ▼ -

Soil Boring: B-2

SOLID GROUND
CONSULTING ENGINEERS

Project: Lebanon WTP GAC Facility
Location: Lebanon, KY
Project Number: 26-121

Date Started: 02/10/2026	Date Completed: 02/10/2026	Coordinates: 37.514041, -85.262393
Location Accuracy: Estimated from Google Maps	Client Name: Kentucky Engineering Group, PLLC	Hammer Type: Auto
Method: Auger	Depth: 14.4'	

Rig Type: Diedrich D-50
Tooling: 3-1/4" Hollow Stem Auger
Surface Elevation: 628.2'

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	Samples: Depth of Sample (ft)	Samples: Sample Graphic	Samples: Blow Counts	Samples: Uncorrected N-Value	Lab: Moisture Content (%)
			Topsoil 0.5	0 ft	SS	2-3-2	5	
			FILL, **Lean Clay with Gravel**, soft to firm, moist, brown, trace silt, trace coal fragments (CL) 2	2 ft				
	625		**Lean Clay**, wet, brown, little gravel, trace silt, chert fragment (CL) 4.5	4.5 ft	SS	2-3-3	6	21.5
5			**Lean Clay**, soft, damp to slightly moist, brown, trace silt (CL)	7 ft	SS	2-1-2	3	
	620		7': soft to firm 9.5	9.5 ft	SS	2-2-3	5	27.9
10			**Lean to Fat Clay**, firm, moist, brown, gray mottling (CL-CH)		SS	3-4-5	9	
	615		14.4					

Auger refusal at 14.4'

Graphics Legend

- CL-CH
- CL
- Topsoil
- SS - Small Split Spoon

Water Levels

- ▽ -
- ▼ -

Soil Boring: B-3

SOLID GROUND
CONSULTING ENGINEERS

Project: Lebanon WTP GAC Facility
Location: Lebanon, KY
Project Number: 26-121

Date Started: 01/23/2026	Date Completed: 01/23/2026	Coordinates: 37.513949, -85.262400
Location Accuracy: Estimated from Google Maps	Client Name: Kentucky Engineering Group, PLLC	Hammer Type: Auto
Method: Auger	Depth: 19'	

Rig Type: Mobile B-25
Tooling: 3-1/4" Hollow Stem Auger
Surface Elevation: 631.3'

Depth (ft)	Elevation (ft)	Visual Classification and Remarks	Depth of Sample (ft)	Blow Counts	Uncorrected N-Value	% Fines	Atterberg Limits (LL-PL-PI)	Moisture Content (%)
		Topsoil 0.3	0 ft	3-3-3	6			
	630	**FILL**, **Clayey Gravel**, loose, moist, dark brown, (GC) 2.5	2.5 ft					
		Lean Clay, firm to stiff, moist, brown, some gravel (CL) 5	5 ft	4-4-6	10		39-18-21	
5	625	**Lean Clay with Gravel**, firm, moist, brown, shale fragments (CL)		2-3-3	6	71.8		24.0
			7.5 ft					
		7.5': orange mottling, no shale fragments		2-4-4	8			28.2
10	620	10': no mottling	10 ft	3-4-5	9			
		15	15 ft					
15	615	**Lean to Fat Clay with Gravel**, stiff, moist, orangish brown, some sand, gray and black mottling (CL-CH) 19		4-6-7	13			22.1
		Auger refusal at 19'						

Graphics Legend

- CL
- CL-CH
- GC
- SS - Small Split Spoon
- Topsoil

Water Levels

- ▽ -
- ▼ -

Soil Boring: B-4

SOLID GROUND
CONSULTING ENGINEERS

Project: Lebanon WTP GAC Facility
Location: Lebanon, KY
Project Number: 26-121

Date Started: 01/23/2026	Date Completed: 01/23/2026	Coordinates: 37.513857, -85.262490
Location Accuracy: Estimated from Google Maps	Client Name: Kentucky Engineering Group, PLLC	Hammer Type: Auto
Method: Auger	Depth: 8.7'	

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	Samples: Depth of Sample (ft)	Samples: Sample Graphic	Samples: Blow Counts	Samples: Uncorrected N-Value	Lab: Moisture Content (%)
			Rig Type: Mobile B-25 Tooling: 3-1/4" Hollow Stem Auger Surface Elevation: 620.2'					
			Topsoil 0.9	0 ft	X	WOH-2-3	5	22.7
			Lean Clay, soft to firm, moist, grayish brown, trace organics (CL)					
			2.5': orangish brown, gray mottling, some silt, stiff	2.5 ft	X	3-5-7	12	
5	615		5': very stiff, little sand, trace gravel	5 ft	X	5-8-11	19	21.5
			7.5	7.5 ft				
			Lean to Fat Clay, hard, moist to wet, orangish brown, gray and black mottling, trace gravel (CL-CH) 8.7		X	2-2-50/0.2'	52	
			Auger refusal at 8.7'					

Graphics Legend

- CL
- Topsoil
- SS - Small Split Spoon

Water Levels

- ▽ -
- ▼ -

Soil Boring: B-5

SOLID GROUND
CONSULTING ENGINEERS

Project: Lebanon WTP GAC Facility
Location: Lebanon, KY
Project Number: 26-121

Date Started: 02/10/2026	Date Completed: 02/10/2026	Coordinates: 37.513862, -85.262376
Location Accuracy: Estimated from Google Maps	Client Name: Kentucky Engineering Group, PLLC	Hammer Type: Auto
Method: Auger	Depth: 21.3'	

Rig Type: Diedrich D-50
Tooling: 3-1/4" Hollow Stem Auger
Surface Elevation: 631.7'

Depth (ft)	Elevation (ft)	Graphic Log	Visual Classification and Remarks	Samples: Depth of Sample (ft)	Samples: Sample Graphic	Samples: Blow Counts	Samples: Uncorrected N-Value	Lab: Moisture Content (%)
			Topsoil 0.3	0 ft		4-6-5	11	21.5
	630		**FILL**, **Clayey Gravel**, stiff, moist, brown, trace silt, trace coal (GC) 2	2 ft				
			FILL, **Lean Clay**, firm, moist, brown, trace silt, shale fragments (CL) 4.5	4.5 ft		2-3-3	6	
5	625		**Clayey Gravel**, firm, moist, brownish gray, trace silt, shale fragments, gray mottling (GC) 7	7 ft		3-4-4	8	
			Lean Clay, firm, moist, brown, trace silt (CL)	9.5 ft		2-3-5	8	26.6
10	620		9.5': soft to firm, gray mottling 14.5	14.5 ft		2-2-3	5	
15	615		**Lean Clay**, stiff, moist, light brown, trace sand (CL)	19.5 ft		3-6-7	13	21.8
20			19.5': brown, trace gravel 21.3			2-4-7	11	

Auger refusal at 21.3'

Graphics Legend

- CL
- GC
- Topsoil
- SS - Small Split Spoon

Water Levels

- ▽ -
- ▼ -

Soil Boring: B-6

SOLID GROUND
CONSULTING ENGINEERS

Project: Lebanon WTP GAC Facility
Location: Lebanon, KY
Project Number: 26-121

Date Started: 02/10/2026	Date Completed: 02/10/2026	Coordinates: 37.513760, -85.262385
Location Accuracy: Estimated from Google Maps	Client Name: Kentucky Engineering Group, PLLC	Hammer Type: Auto
Method: Auger	Depth: 21.1'	

Rig Type: Diedrich D-50
Tooling: 3-1/4" Hollow Stem Auger
Surface Elevation: 630.9'

Depth (ft)	Elevation (ft)	Visual Classification and Remarks	Depth of Sample (ft)	Blow Counts	% Recovery	% RQD	Uncorrected N-Value	Moisture Content (%)
	630	**Topsoil** 0.4	0 ft	3-2-5			7	
		FILL, **Clayey Gravel**, firm, wet, brown, trace silt, trace coal (GC) 2	2 ft	4-5-6			11	23.6
▽		**FILL**, **Lean Clay**, stiff, moist, brown, some shale, trace silt (CL) 4.5	4.5 ft					
5	625	**Clayey Gravel**, soft to firm, moist, gray, trace silt (GC) 7	7 ft	3-3-2			5	
		Lean Clay, firm, moist, brown, trace silt (CL)	9.5 ft	4-3-5			8	
10	620	9.5': stiff, gray mottling		2-5-6			11	21.9
			14.5 ft					
15	615	14.5': trace sand, trace rock fragments		3-3-8			11	
			19.5 ft					
20	610	19.5': soft to firm, reddish brown, black mottling 21.1	21.1 ft	3-2-3			5	36.5
		Interbedded Limestone and Dolomite, ***Laminated***, fine grained, GRAY 23.4	23.4 ft		100	48		
		Dolomite, fine grained, GRAY 26.1	26.1 ft		89	56		
25	605	**Interbedd Limestone and Shale**, ***Very Thinly Bedded***, fine to medium grained, GRAY, 28.1			100	84		
30	600	**Dolomite**, fine grained, LIGHT GRAY, minor shale, blue/green hue 31.1						
		Boring terminated at 31.1'						

Graphics Legend

- ▽ Water After Coring
- Dolomite
- CL
- GC
- Topsoil
- Interbedded Limestone and
- Interbedd Limestone and
- Core
- SS - Small Split Spoon

Water Levels

- ▽ 4.4' After Coring
- ▼ -

SOLID GROUND
CONSULTING ENGINEERS

Distribution:

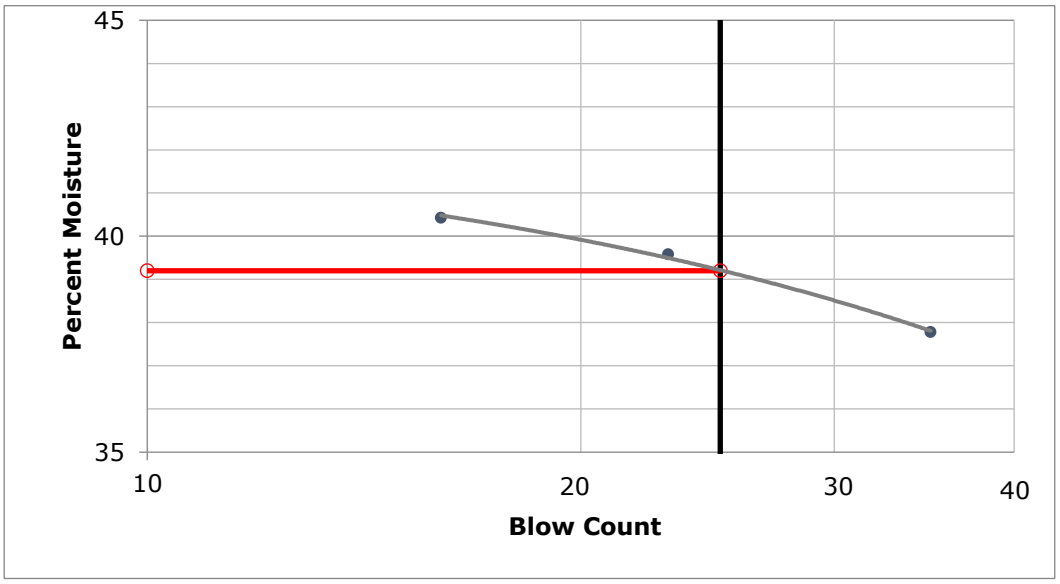
Report:

Project Name	Lebanon WTP	Project #	26-121
Sample #	B3	Depth	2.5'-4.0'
Soil Description	Brown LEAN CLAY	Prep. Method	DRY
Date Sample Received	1/26/2026	Date Tested	2/6/2026

LIQUID LIMIT

Run Number	1	2	3	4	5	6
Tare Number	31	234	240			
Tare + Wet Soil	19.7	20.1	20.1			
Tare + Dry Soil	18.0	18.2	18.2			
Weight of Water	1.7	1.9	1.9			
Weight of Tare	13.5	13.4	13.5			
Weight of Dry Soil	4.5	4.8	4.7			
Water Content	37.8	39.6	40.4			
Number of Blows	35	23	16			

Liquid limit test was performed using manual device and metal grooving tool



LL 39

PL 18

PI 21

SYMBOL FROM PLASTICITY CHART

CL

USCS

LEAN CLAY (CL)

PLASTIC LIMIT

Run Number	1	2	3	4	5	Natural Moisture
Tare Number	15	116				
Tare + Wet Soil	19.1	19.2				
Tare + Dry Soil	18.3	18.4				
Weight of Water	0.8	0.8				
Weight of Tare	13.8	13.8				
Weight of Dry Soil	4.5	4.6				
Water Content	17.8	17.4				
Plastic Limit	17.6					

Plastic limt test specimens were hand rolled

SOLID GROUND
— CONSULTING ENGINEERS —

Distribution:

Report of Percent Passing No. 200 Sieve
ASTM D1140

Project Name	Lebanon WTP	Project #	26-121
Sample #	B3	Depth	5.0'-6.5'
Soil Description	Brown LEAN CLAY with gravel	Method A or B	B
Date Sample Received	1/26/2026	Date Tested	2/6/2026

Boring/Sample No.	B3					
Depth (From-To)	5.0'-6.5'					

#200 DATA						
Tare Number	LRP					
Wet Soil + Tare, g	837.1					
Dry Soil + Tare, g	528.1					
Wt. of Tare	437.0					
Wt. of Dry Soil, g	91.1					
Soak Time, hours	24					

% MOISTURE DATA						
Tare Number	13	129				
Wet Soil + Tare, g	69.7	70.1				
Dry Soil + Tare, g	58.6	59.4				
Wt of Water	11.1	10.7				
Wt of Tare	13.5	13.7				
Wt. of Dry Soil, g	45.1	45.7				
% Moisture	24.6	23.4				

CALCULATIONS						
Dry Wt. Before, g	322.63					
Dry Wt. After, g	91.10					
% Retained	28.2					
% Passing	71.8					

SOLID GROUND
CONSULTING ENGINEERS

Distribution:

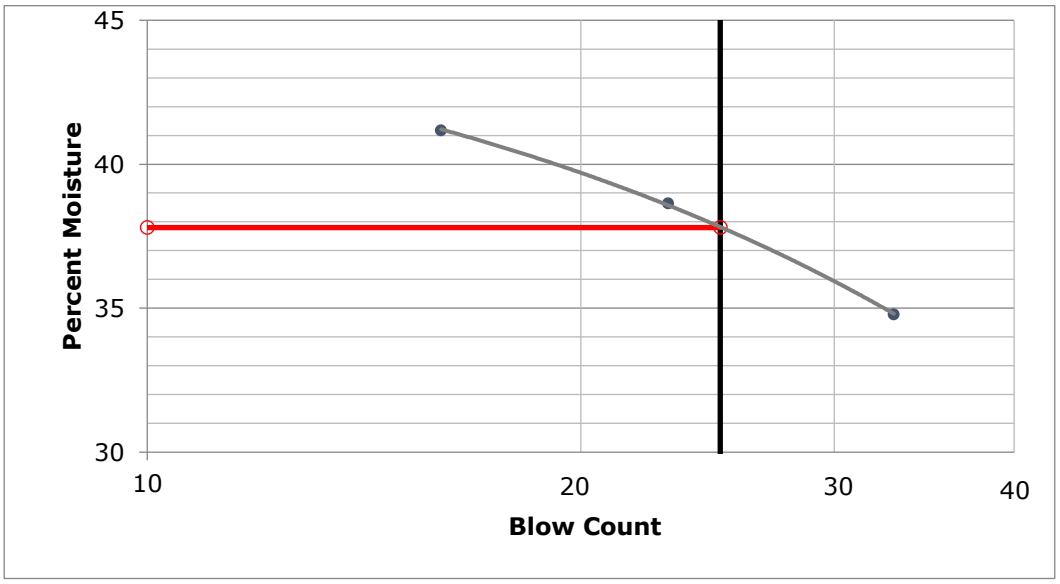
Report:

Project Name	Lebanon WTP	Project #	26-121
Sample #	B6	Depth	7.0'-8.5'
Soil Description	Brown LEAN CLAY	Prep. Method	DRY
Date Sample Received	2/11/2026	Date Tested	2/18/2026

LIQUID LIMIT

Run Number	1	2	3	4	5	6
Tare Number	24	11	148			
Tare + Wet Soil	19.9	20.0	20.6			
Tare + Dry Soil	18.3	18.3	18.5			
Weight of Water	1.6	1.7	2.1			
Weight of Tare	13.7	13.9	13.4			
Weight of Dry Soil	4.6	4.4	5.1			
Water Content	34.8	38.6	41.2			
Number of Blows	33	23	16			

Liquid limit test was performed using manual device and metal grooving tool



LL	38
PL	22
PI	16
SYMBOL FROM PLASTICITY CHART	CL
USCS	LEAN CLAY (CL)

PLASTIC LIMIT

Run Number	1	2	3	4	5	Natural Moisture
Tare Number	44	15				
Tare + Wet Soil	19.4	19.4				
Tare + Dry Soil	18.4	18.4				
Weight of Water	1.0	1.0				
Weight of Tare	13.9	13.8				
Weight of Dry Soil	4.5	4.6				
Water Content	22.2	21.7				
Plastic Limit	22.0					

Plastic limt test specimens were hand rolled

SOLID GROUND
— CONSULTING ENGINEERS —

Distribution:

Report of Percent Passing No. 200 Sieve
ASTM D1140

Project Name	Lebanon WTP	Project #	26-121
Sample #	B6	Depth	9.5'-11.0'
Soil Description	Brown LEAN CLAY	Method A or B	B
Date Sample Received	2/11/2026	Date Tested	2/18/2026

Boring/Sample No.	B6					
Depth (From-To)	9.5'-11.0'					

#200 DATA						
Tare Number	LRP					
Wet Soil + Tare, g	719.6					
Dry Soil + Tare, g	328.9					
Wt. of Tare	319.4					
Wt. of Dry Soil, g	9.5					
Soak Time, hours	24					

% MOISTURE DATA						
Tare Number	25	56				
Wet Soil + Tare, g	70.1	69.3				
Dry Soil + Tare, g	60.0	59.2				
Wt of Water	10.1	10.1				
Wt of Tare	13.6	13.4				
Wt. of Dry Soil, g	46.4	45.8				
% Moisture	21.8	22.1				

CALCULATIONS						
Dry Wt. Before, g	328.28					
Dry Wt. After, g	9.50					
% Retained	2.9					
% Passing	97.1					

Natural Moisture Content Determination (ASTM D2216)

Project Name: Lebanon WTP Date: 1/30/2026

Project Number: 26-121 Page: 1 of 1

Boring Number	Sample Depth (ft)	Can ID Number	Can Weight	Wet Weight + Can	Dry Weight + Can	Moisture %
B1	0.0-1.5	108	13.4	70.1	57.2	29.5
		51	13.8	69.3	56.7	29.4
B1	5.0-6.5	36	13.8	69.6	59.3	22.6
		10	13.3	71.0	60.9	21.2
B1	7.5-8.9	34	13.3	68.9	48.4	58.4
		38	13.4	69.7	50.6	51.3
B2	2.0-3.5	47	13.8	69.8	59.8	21.7
		12	13.6	70.1	60.2	21.2
B2	7.0-8.5	119	13.8	68.9	57.0	27.5
		20	13.4	71.2	58.5	28.2
B3	5.0-6.5	13	13.5	69.7	58.6	24.6
		129	13.7	70.1	59.4	23.4
B3	7.5-9.0	48	13.2	70.5	58.6	26.2
		33	13.2	68.9	56.0	30.1
B3	15.0-16.5	52	13.4	70.3	59.9	22.4
		31	13.4	69.6	59.5	21.9
B4	0.0-1.5	112	13.5	70.5	59.9	22.8
		56	13.3	69.1	58.8	22.6
B4	5.0-6.5	50	13.5	70.7	60.5	21.7
		147	13.3	68.9	59.1	21.4
B5	0.0-1.5	126	13.7	69.9	59.1	23.8
		233	13.8	68.5	59.7	19.2
B5	7.0-8.5	3	13.4	70.2	57.8	27.9
		57	13.6	68.6	57.5	25.3
B5	14.5-16.0	40	13.6	69.0	59.2	21.5
		14	13.7	69.5	59.4	22.1
B6	2.0-3.5	55	13.7	69.6	59.0	23.4
		22	13.3	69.1	58.4	23.7
B6	9.5-11.0	25	13.6	70.1	60.0	21.8
		56	13.4	69.3	59.2	22.1
B6	19.5-21.0	19	13.8	70.0	55.4	35.1
		27	13.6	70.8	55.1	37.8