

Project Manual for **TOWN OF WHEATLAND, INDIANA**



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Wheatland Wastewater System Improvements Division I –
Wastewater Treatment and Regional Lift Station

Prepared by **RQAW**
January 2023

TOWN OF WHEATLAND, INDIANA
WHEATLAND WASTEWATER SYSTEM DIVISION I – WASTEWATER TREATMENT PLANT AND REGIONAL LIFT STATION

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Treatment Plant and Regional Lift Station
Invitation for Bid Publication**

Notice is hereby given, that the Town of Wheatland, in Knox County, Indiana, by and through its Town Council, hereinafter referred to as the Owner, will receive sealed bid packets for the construction of the Wheatland Wastewater System Improvements Project.

Sealed bids must be received by the Town no later than 9:00 A.M. (Local Time) on January 31st, 2023. Bids received after such hour will be returned unopened. Bids received prior to this time shall be opened at a public meeting scheduled to take place on January 31st, 2023 at 9:00 A.M. at the Wheatland Water Department, 121 IN-550, Wheatland, IN 47597. All interested citizens are invited to attend. Should any citizens require special provisions, such as handicapped modifications or non-English translation personnel, the Town will provide such provisions as long as the request is made by January 20th, 2023. The last day for questions is January 25th, 2023.

A pre-bid meeting will be held at 10:00 A.M. (Local Time) on January 23rd, 2023 at the Wheatland Water Department, 121 IN-550, Wheatland, IN 47597. All prime contractors, subcontractors, small, minority or women owned enterprises and other interested parties are invited to attend.

A final addendum will be issued no later than January 27th, 2023.

The Project will be constructed in two (2) contract divisions which are defined and outlined as follows:

Division I includes the installation of a complete lift station, construction and startup of a AeroMod brand package extended aeration plant with a design flow of 58,600 gallons per day, construction and startup of a UV disinfection system and post-aeration system, refinishing an existing pole barn space to outfit it with necessary equipment, various potential alternates, and all other associated work as required by the Contract Documents to provide a fully operational wastewater treatment system within the Town of Wheatland, IN.

Division II includes the installation of approximately 27,000 feet of 8-inch gravity sanitary sewer, the installation of approximately 100 48-inch manholes, and the installation of laterals for all indicated residents, along with all associated work as required by the Contract Documents to provide a fully operational sewer system within the Town of Wheatland, IN.

Copies of the Plans and Contract Documents and Specifications for each division of work may be obtained from the "Public Documents" section of the RQAW website at <https://rqaw.com/public-documents/>.

The work to be performed and the bid to be submitted shall include sufficient and proper sums for all general construction, mechanical installation, labor, materials, permits, licenses, insurance, and so forth incidental to and required for the construction of the facilities.

Each bid must be enclosed in a sealed envelope bearing the title of the Project and the name and address of Bidder. All bids must be submitted on the bid forms as identified in the Contract Documents and Specifications.

Each bid shall be accompanied by a certified check or acceptable bidder's bond made payable to the Owner, in a sum of not less than five percent (5%) of the total amount of the highest aggregate bid, which check or bond will be held by the Owner as evidence that the bidder will, if awarded the contract, enter into the same with the Owner upon notification from him to do so within ten (10) days of said notification.

Approved performance and payment bonds guaranteeing faithful and proper performance of the work and materials, to be executed by an acceptable surety company, will be required of the Contractor at the time of contract execution. The bonds will be in the amount of 100% of the Contract Price and must be in full force and effect throughout the term of the Construction Contract plus a period of twelve (12) months from the date of substantial completion.

The Owner reserves the right to reject any bid, or all bids, or to accept any bid or bids, or to make such combination of bids as may seem desirable, and to waive any and all informalities in bidding. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bid may be withdrawn after the scheduled closing time for receipt of bids for at least sixty (60) days.

A conditional or qualified Bid will not be accepted.

Award will be made to the low, responsive, responsible bidder. The low, responsive, responsible bidder must not be debarred, suspended, or otherwise be excluded from or ineligible for participation in federally assisted programs under Executive Order 12549.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the project throughout.

Bids shall be properly and completely executed on bid forms included in the Specifications. Bids shall include all information requested by Indiana Form 96 (Revised 2013) included with the Specifications. Under Section III of Form 96, the Bidder shall submit a financial statement. A copy of the proposed Financial Statement to be submitted with the bid is included in the bid documents section to these specifications. The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the work and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the work contemplated therein.

Each Bidder is responsible for inspecting the Project site(s) and for reading and being thoroughly familiar with the Contract Documents and Specifications. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation with respect to its Bid.

Wage rates on the project shall not be less than the federal wage scale published by the U.S. Department of Labor.

Bidders on this work shall be required to comply with the provisions of the President's Executive Order No. 11246, as amended. The Bidders shall also comply with the requirements of 41 CFR Part 60 - 4 entitled Construction Contractors - Affirmative Action Requirements. A copy of 41 CFR Part 60 - 4 may be found in the Supplemental General Conditions of the Contract Documents and Specifications.

The Bidders' attention is also called to the "Minority/Women Business Participation" requirements contained in the Project Specifications.

Contract procurement is subject to the federal regulations contained in the OMB Circular A-102, Sections B and O and the State of Indiana requirements contained in IC-36-1-9 and IC-36-1-12.

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INSTRUCTIONS TO BIDDERS

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ARTICLE 1 – DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office* – The office from which the Bidding Documents are to be issued. The Issuing Office is as stated in Section 00 11 13 - Advertisement for Bids.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

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

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

- 3.01 To demonstrate Bidder’s qualifications to perform the Work, Bidder shall submit with its Bid (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:
- A. Evidence of Bidder’s authority to do business in the state where the Project is located.
- B. Bidder’s state or other contractor license number, if applicable.
- C. Subcontractor and Supplier qualification information; coordinate with provisions of Article 12 of these Instructions, “Subcontractors, Suppliers, and Others.”
- D. Contractor’s Bid for Public Work - Form 96
- E. SRF Documents due at time of Bid
1. Form OEE-1
 2. Form OEE-2
 3. Green Project Reserve Bid Breakdown Form
 4. American Iron and Steel Certification
- F. SRF Documents due 48 hours after Bid Opening
1. Form 6100-3
 2. Form 6100-4
 3. Bidder’s List Form
 4. Good Faith Efforts Worksheet

- 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. No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.
- 3.03 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

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

4.01 *Site and Other Areas*

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

4.02 *Existing Site Conditions*

- A. Subsurface and Physical Conditions;
1. In the preparation of the Contract Documents, Engineer relied upon the following reports of explorations and tests of subsurface conditions at the Site of the Work.
 - a. A report prepared by Atlas Technical Consultants, LLC, Indianapolis, Indiana.
 - b. The reports and drawings referenced above are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
 2. No reports or drawings relating to Hazardous Environmental Conditions have been identified at or adjacent to the Site.
- 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. Bidders must advise Ms. Erika Goble at (812) 321-2340 of the date and time they desire to conduct their Site visit.
- 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 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; carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;
- D. 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;
- E. 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;
- F. 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;
- G. 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;
- H. 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
- I. 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 Pre-Bid conference will be held at the time and location stated in the invitation to bids. Representatives of Owner and Engineer will be present to discuss the Project. Engineer will transmit to all planholders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

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

ARTICLE 8 – BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.
- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.
- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be substantially completed and 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 Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

- 11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract

allows the Contractor to request that Engineer authorize the use of a substitute or “or-equal” item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

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

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS AND OTHERS

- 12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.
- 12.02 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.
- 12.03 The apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work:
- A. Packaged Treatment Plant
 - B. UV Equipment Manufacturer
 - C. Premanufactured Building
 - D. Submersible Lift Station Pumps
 - E. Variable Frequency Drives
 - F. Electrical Subcontractor
 - G. Mechanical Subcontractor
 - H. Integrator
 - I. Site Piping Subcontractor
 - J. Under-Railroad Sewer Installation Subcontractor (if different than above)
 - K. Coatings Subcontractor (if needed)
 - L. Pipe Supplier
 - M. Manhole Supplier

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

in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

- 12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, 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.

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 seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown.
- 13.03 A Bid by a partnership 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 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.
- 13.05 A Bid by an individual shall show the Bidder's name and official address.
- 13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.
- 13.07 All names shall be printed in ink below the signatures.
- 13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

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

ARTICLE 14 – BASIS OF BID

14.01 Base Bid with Alternates

- A. Bidders shall submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.
- B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.

14.02 Allowances

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

ARTICLE 15 – SUBMITTAL OF BID

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

Ms. Erika Goble, Deputy Clerk
Town of Wheatland
P.O. Box 219
Wheatland, IN 47597

- 15.02 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 to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.
- 19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.
- 19.03 Evaluation of Bids
- A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
 - B. The Successful Bidder will be selected based on their base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.”
- 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, payment, and maintenance 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 – SALES AND USE TAXES

22.01 Owner is exempt from Indiana state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Bid. Refer to Paragraph SC-7.09 of the Supplementary Conditions for additional information.

ARTICLE 23 – SRF LOAN REQUIREMENTS

23.01 Financing for this project is expected to be through the Indiana Finance Authority State Revolving Fund Program. The SRF forms listed in Article 3.01 shall be submitted to the Owner by the prescribed date.

23.02 Davis-Bacon Wages

- A. Bidder shall take note that wages paid throughout the project must meet or exceed those outlined in the Davis-Bacon Wage guidelines provided in Exhibit B of the Bidding Documents.

23.03 U.S. EPA Green Project Reserve Program

- A. Certain portions of components of this Project, which are described in the GPR Bid Breakdown Form (Exhibit E) furnished with the Bid Documents, qualify for the U.S. EPA Green Project Reserve (GPR) Program and/or Sustainability Incentive offered by the Indiana State Revolving Fund (SRF) Loan Program. Bidders shall complete the GPR Bid Breakdown form and submit the completed form with its Bid. This information is required by the U.S. EPA and the Indiana Finance Authority SRF Program and Bidder's failure to fully and accurately complete the GPR Bid Breakdown form and submit it with its Bid may result in the Bid being rejected as non-responsive.

(NO TEXT FOR THIS PAGE)

RQAW Corporation

Wheatland Wastewater System Improvements
Division I – Wastewater Treatment Plant and
Regional Lift Station

BID FORM

Town of Wheatland, Indiana

Wheatland Wastewater System Improvements Division I – Wastewater Treatment Plant and Regional
Lift Station

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ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Town of Wheatland

P.O. Box 219

Wheatland, IN 47597

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

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

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

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

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

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

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

3. “collusive practice” means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

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

Description	Unit	Estimated Quantity	Unit Price
Wastewater Treatment Plant and Regional Lift Station, Complete	LS	1	\$

Total Base Bid Price \$ _____

BID ALTERNATE

Item No.	Description	Unit	Estimated Quantity	Total Add or Deduct (Write-In)
1	Bid Alt 1 – Pole Barn Roof and Rafter Repairs	LS	1	\$
2	Bid Alt 2 – Pole Barn Office and Restroom Buildout	LS	1	\$
3	Bid Alt 3 - Sludge Drying Bed	LS	1	\$
4	Bid Alt 4 - WWTP Site Fencing and Slide Gate	LS	1	\$

Total Base Bid Price – Bid Alternate \$ _____

Proposed increase or decrease in price for the Bid Alternates listed above will be considered in determination of the lowest responsive and responsible bid.

The undersigned understands that after a contract is awarded, the Owner may select items of the Alternate Bids listed above. If awarded the contract, the Bidder agrees to furnish and install any Owner selected Alternate items for the add or deduct indicated. The total base bid will then be adjusted accordingly. The add or deduct amounts listed above are “installed” prices and take into consideration and include any cost of the design or construction changes that may be required as a result of selecting the Alternate.

Alternate Contract Item prices are subject to acceptance by the Owner, and rejection of one or more Alternate Contract Item prices will not invalidate acceptance of this Bid.

ARTICLE 6 – TIME OF COMPLETION

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

ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01 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. Bidder’s License No.: [REDACTED] demonstrating evidence of authority to do business in the state of Indiana.
 - F. Required Bidder Qualification Statement (Form 96) with supporting data;
 - G. Wage/Fringe Benefit Certification (Exhibit C);
 - H. GPR Bid Breakdown (Exhibit E);
 - I. American Iron and Steel Certification (Exhibit F);
 - J. Form OEE-1 (Exhibit G);
 - K. Form OEE-2 (Exhibit G);
 - L. Good Faith Efforts Worksheet (Exhibit G);
 - M. E-Verify Affidavit

ARTICLE 8 – DEFINED TERMS

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

ARTICLE 9 – BID SUBMITTAL

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

By:
[Signature] _____

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

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

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

(NO TEXT FOR THIS PAGE)

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*):

Town of Wheatland
P.O. Box 219
Wheatland, Indiana 47597

BID

Bid Due Date: January 31, 2023

Description (*Project Name— Include Location*): Wheatland Wastewater System Improvements Division I –
Wastewater Treatment Plant and Regional Lift Station

BOND

Bond Number:

Date:

Penal sum _____ \$ _____

(Words)

(Figures)

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

BIDDER

SURETY

(Seal)

(Seal)

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

By:

Signature

By:

Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest:

Signature

Attest:

Signature

Title

Title

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

Provide execution by any additional parties, such as joint venturers, if necessary.

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

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

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

3. This obligation shall be null and void if:

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

3.2 All Bids are rejected by Owner, or

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

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

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

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

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

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

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

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

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

SECTION 00 45 13 – E-VERIFY AFFIDAVIT

LEGAL EMPLOYMENT DECLARATION

The State of Indiana, in IC §22-5-1.7, requires all state agencies and political subdivisions to seek verification from their contractors that the contractor’s employees are legally eligible to work in the United States.

This Declaration serves as notice that all Contractors doing business with the West Central Conservancy District must, as a term of their contract:

1. Enroll in and verify the work eligibility status of newly hired employees of the contractor through the United States government’s E-Verify program (but is not required to do so if the E-Verify program no longer exists); and
2. Verify, by signature below, that the Contractor does not knowingly employ unauthorized aliens.

I, _____, a duly authorized agent of _____ (name of Company), declare under penalties of perjury that _____ (name of Company) has verified the work eligibility status of its employees and it does not employ unauthorized aliens to the best of its knowledge and belief.

(Name of Company)

By: _____
(Authorized Representative of Company)

PLEASE SEE <https://e-verify.uscis.gov/enroll/StartPage.aspx?JS=YES> FOR INSTRUCTIONS AND ELECTRONIC REGISTRATION FOR E-VERIFY.

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CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)

Prescribed by State Board of Accounts

PART I

(To be completed for all bids. Please type or print)

Date (month, day, year): _____

1. Governmental Unit (Owner): _____ land _____

2. County : _____

3. Bidder (Firm): _____

Address: _____

City/State/ZIPcode: _____

4. Telephone Number: _____

5. Agent of Bidder (if applicable): _____

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of _____

(Governmental Unit) in accordance with plans and specifications prepared by RQAW Corporation

_____ and dated _____ for the sum of _____ \$ _____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids apply, the undersigned submits a proposal for each in accordance with the notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit basis, the itemization of the units shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment, to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS

(If applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I.C. 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

ACCEPTANCE

The above bid is accepted this _____ day of _____, _____, subject to the following conditions: _____

Contracting Authority Members:

PART II (For projects of \$170,000 or more – IC 36-1-12-4)

Governmental Unit: _____

Bidder (Firm) _____

Date (month, day, year): _____

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

2. What public works projects are now in process of construction by your organization?

Contract Amount	Class of Work	Expected Completion Date	Name and Address of Owner

3. Have you ever failed to complete any work awarded to you? _____ If so, where and why?

4. List references from private firms for which you have performed work.

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. *(Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)*

2. Please list the names and addresses of all subcontractors *(i.e. persons or firms outside your own firm who have performed part of the work)* that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

SECTION IV CONTRACTOR'S NON – COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to include anyone to refrain from bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

SECTION V OATH AND AFFIRMATION

I HEREBY AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FACTS AND INFORMATION CONTAINED IN THE FOREGOING BID FOR PUBLIC WORKS ARE TRUE AND CORRECT.

Dated at _____ this _____ day of _____, _____

_____ *(Name of Organization)*

By _____

_____ *(Title of Person Signing)*

ACKNOWLEDGEMENT

STATE OF _____)
COUNTY OF _____) ss

Before me, a Notary Public, personally appeared the above-named _____ and swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to before me this _____ day of _____, _____.

_____ *Notary Public*

My Commission Expires: _____

County of Residence: _____

BID OF

_____ (Contractor)

_____ (Address)

**FOR
PUBLIC WORKS PROJECTS
OF**

Filed _____

Action taken _____

NOTICE OF AWARD

Date of Issuance:

Owner: Town of Wheatland, IN

Owner's Contract No.: N/A

Engineer: RQAW Corporation

Engineer's Project No.: 21-400-194-1

Project: Wheatland Wastewater System
Improvements Division I – Wastewater Treatment
Plant and Regional Lift Station

Contract Name:

Bidder:

Bidder's Address:

TO BIDDER:

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

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

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

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

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

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

1. Deliver to Owner [] counterparts of the Agreement, fully executed by Provider.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Request for Qualifications 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, and annul this Notice of Award.

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: Town of Wheatland, IN

By: Erika Goble

Title: Deputy Clerk

Copy: Engineer

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Contract Times commence to run), and completed and ready for final payment in accordance with paragraph 15.06 of the General Conditions within **560 calendar days** after the date when the Contract Times commence to run.

- B. It is expressly understood and agreed, by and between the Contractor and Owner that the Contract Time for completion of the work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work and excludes the time for unavoidable delays which were beyond the control and without the fault of the Contractor.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. Substantial Completion: Contractor shall pay Owner \$1,500.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.
 2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$750.00 for each day that expires after such time until the Work is completed and ready for final payment.
 3. Liquidated damages for failing to timely attain Substantial Completion and Final Completion are not additive and will not be imposed concurrently.

4.04 *Special Damages*

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

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 amount of: _____ (\$ _____).

The above amount is based on the unit price bid determined by the Contractor. Final adjustments of quantities may affect this price.

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 after the **1st** or **3rd** Tuesday 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. 10 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.
2. At Contractor's option, the Contractor may set-up an escrow account and enter into a separate escrow agreement with the Owner and an escrow agent. Anytime retainage is withheld, it shall be placed into the agreed upon escrow account. Set-up escrow account such that once retainage is withheld, it can only be released once written consent is provided by both the Owner and Contractor.

- B. Upon Substantial Completion, Owner may pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less 200 percent of Engineer's estimate of the value of Work to be completed or corrected attached to the certificate of Substantial Completion and such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work 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 – CONTRACTOR'S REPRESENTATIONS

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

- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
- B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.
- F. Based on the information and observations referred to in the preceding paragraphs, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 8 – CONTRACT DOCUMENTS

8.01 *Contents*

- A. The Contract Documents consist of the following:
 - 1. This Agreement, identified as Section 00 52 00.
 - 2. Addenda (numbers █ to █, inclusive).
 - 3. Notice of Award, identified as Section 00 51 00.
 - 4. Notice to Proceed, identified as Section 00 55 00.
 - 5. Performance bond, identified as Section 00 61 13.13.
 - 6. Payment bond, identified as Section 00 61 13.16.
 - 7. Maintenance bond, identified as Section 00 61 19.
 - 8. General Conditions, identified as Section 00 72 00.
 - 9. Supplementary Conditions, identified as Section 00 73 00.
 - 10. Specifications bearing the title Wheatland Wastewater System Improvements Division I – Wastewater Treatment Plant and Regional Lift Station as listed in the table of contents of the Project Manual.
 - 11. Drawings (not attached but incorporated by reference) bearing the title Wheatland Wastewater System Improvements Division I – Wastewater Treatment Plant and Regional Lift Station
 - 12. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages █ to █, inclusive).
 - b. Documentation submitted by Contractor prior to Notice of Award.
 - 13. Governing Order of Contract Documents – In the event that any provision in any of the above component parts of this Agreement conflicts with any provision in any other of the component parts, the provision in the component part first enumerated above shall govern over any other component part which follows it numerically except as may be otherwise specifically stated.
 - 14. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:

- a. Work Change Directives.
 - b. Change Orders.
 - c. Field Orders.
- B. The documents listed in Paragraph 8.01.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 8.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 9 – MISCELLANEOUS

9.01 Terms

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

9.02 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.

9.03 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.

9.04 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.

9.05 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 9.05:
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.

9.06 *Other Provisions*

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

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

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

OWNER:

CONTRACTOR:

Town of Wheatland, IN

By: _____

By: _____

Title: Town Council 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:

Town of Wheatland

P.O. Box 219

Wheatland, IN 47597

License No.: _____
(where applicable)

NOTICE TO PROCEED

Owner: Town of Wheatland

Owner's Contract No.: N/A

Contractor:

Contractor's Project No.:

Engineer: RQAW Corporation

Engineer's Project No.: 21-400-194-1

Project: Wheatland Wastewater System
Improvements Division I – Wastewater
Treatment Plant and Regional Lift Station

Contract Name: Wheatland Wastewater System
Improvements Division I – Wastewater Treatment
Plant and Regional Lift Station

Effective Date of Contract:

TO PROVIDER:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 2023]. *[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 500 days from notice to proceed, and the date of readiness for final payment is 560 days from notice to proceed.

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

Comply with all requirements as stated in the Contract Documents.

Owner: Town of Wheatland, Indiana

By: Brett Dawson

Title: Town Council President

Date Issued:

Copy: Engineer

(NO TEXT FOR THIS PAGE)

PERFORMANCE BOND

CONTRACTOR *(name and address):*

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

OWNER *(name and address):*

Town of Wheatland
 P.O. Box 219
 Wheatland, Indiana 47597

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description *(name and location):*

BOND

Bond Number:

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

Amount:

Modifications to this Bond Form: None See Paragraph 16

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

CONTRACTOR AS PRINCIPAL

SURETY

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

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

By: _____
 Signature

By: _____
 Signature *(attach power of attorney)*

 Print Name

 Print Name

 Title

 Title

Attest: _____
 Signature

Attest: _____
 Signature

 Title

 Title

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

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

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

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

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

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

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

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

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

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

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

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence,

to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

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

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

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

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

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

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

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

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

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

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

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

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

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

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

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims

for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

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

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

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

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

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

16. Modifications to this Bond are as follows:

(NO TEXT FOR THIS PAGE)

PAYMENT BOND

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

CONTRACTOR (*Name and Address*):

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

OWNER (*Name and Address*):

Town of Wheatland
P.O. Box 219
Wheatland, Indiana 47597

CONTRACT

Effective Date of Agreement:
Amount:
Description (*Name and Location*):

BOND

Bond Number:
Date (*Not earlier than Effective Date of Agreement*):
Amount:
Modifications to this Bond Form:

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

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal (Seal)

Surety's Name and Corporate Seal (Seal)

By: _____
Signature

By: _____
Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to Owner, this obligation shall be null and void if Contractor:
 - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2 Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.
3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1 Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
 - 4.2 Claimants who do not have a direct contract with Contractor:
 1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
 2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
 3. Not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.
5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.
6. Reserved.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.
8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.
9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

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

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, 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 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.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

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

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. Definitions

15.1 Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms “labor, materials or equipment” that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and 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.

15.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract, or to perform and complete or otherwise comply with the other terms thereof.

FOR INFORMATION ONLY – *(Name, Address, and Telephone)*

Surety Agency or Broker:

Owner’s Representative *(Engineer or other)*:

(NO TEXT FOR THIS PAGE)

MAINTENANCE BOND

Bond No. _____

KNOW ALL PEOPLE BY THESE PRESENTS:

That we, _____
(hereinafter called CONTRACTOR), and _____, a
corporation organized under the laws of the State of _____ and
authorized to do a surety business in the State of Indiana, (hereinafter called Surety), are held and firmly bound
unto the Town of Wheatland, Indiana (hereinafter called the OWNER) in the sum of (10% of Contract Price),
lawful money of the United States of America, for the payment of which sum, well and truly to be made, we
bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these
presents.

WHEREAS, said CONTRACTOR has performed improvements, which have been or are about to be
completed and accepted by the OWNER for the project known as:

WHEATLAND WASTEWATER SYSTEM IMPROVEMENTS DIVISION
I – WASTEWATER TREATMENT PLANT AND REGIONAL LIFT
STATION

AND WHEREAS, it is required that the CONTRACTOR should guarantee the project from defects
caused by faulty or defective materials, workmanship, or design for a period of one year from and after the date
of acceptance of the completed project by the OWNER.

NOW, THEREFORE, if the CONTRACTOR shall for a period of one year from and after the date of
acceptance of the completed project by the OWNER replace any and all defects arising in said work whether
resulting from faulty or defective materials, workmanship, or design, then the above obligation shall be null and
void; otherwise the obligation shall remain in full force and effect for one year from the date of acceptance of
the completed project by the OWNER.

The OWNER shall notify the CONTRACTOR in writing of any defects for which the CONTRACTOR
is responsible and shall specify in said notice a reasonable time within which the CONTRACTOR shall have to
correct said defects. If the CONTRACTOR fails to correct said defects within the time specified in said notice,
the OWNER, in its discretion, may permit the Surety to correct said defects. If the OWNER allows the Surety to

correct said defects, the Surety shall have sixty (60) days thereafter within which to take such action as it deems necessary to insure performance of the CONTRACTOR's obligation.

If such defects are not corrected after the time period specified in the notice or after the expiration of the sixty (60) day time period, whichever is applicable, the OWNER shall have the right to correct the defects, and the CONTRACTOR and Surety, jointly and severally, shall pay all costs and expenses incurred by the OWNER in correcting the defects, including, but not limited to, the ENGINEER, legal and other costs, together with any damages either direct or consequential, which the OWNER sustains, or may sustain, on account of the CONTRACTOR's failure to correct the defects. In addition, the OWNER shall have the right to contract for the correction of said defects and, upon acceptance of a bid in accordance with the OWNER's normal bidding process, the CONTRACTOR and Surety shall become immediately liable for the amount of the bid. In the event that the OWNER commences legal proceedings for the collection thereof, interest shall accrue on said amount at the rate of six (6) percent per annum, beginning at the commencement of said legal proceedings.

If the OWNER commences suit for collection of any sums due hereunder, the CONTRACTOR and Surety, jointly and severally, agree to pay all costs and expenses incurred by the OWNER, including, but not limited to, attorney's fees.

IN WITNESS WHEREOF, the parties have caused this instrument to be signed and sealed by their respective authorized officers this day of _____ 20__.

CONTRACTOR:

SURETY:

By: _____

By: _____

Title: _____

Title: _____

Address: _____

Address: _____

WITNESS AS TO CONTRACTOR

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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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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

1.02 Terminology

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

3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

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

2.02 *Copies of Documents*

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

2.03 *Before Starting Construction*

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 2. a preliminary Schedule of Submittals; and

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

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

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

2.05 *Initial Acceptance of Schedules*

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

2.06 *Electronic Transmittals*

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

computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

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

3.03 *Reporting and Resolving Discrepancies*

- A. *Reporting Discrepancies:*
 - 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

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

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

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

3.05 *Reuse of Documents*

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

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

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

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. abnormal weather conditions;
 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

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

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

5.01 *Availability of Lands*

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

5.02 *Use of Site and Other Areas*

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

- 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
- 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

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

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 - 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

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

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

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

- c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
 - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
 - 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 - 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings*: The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 2. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

- A. *Workers' Compensation:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 2. claims for damages insured by reasonably available personal injury liability coverage.
 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability:* Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:
1. include at least the specific coverages provided in this Article.
 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

- A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 - 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 - 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 - 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 - 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 - 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 Supervision and Superintendence

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

7.02 Labor; Working Hours

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

7.03 Services, Materials, and Equipment

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

guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

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

7.04 "Or Equals"

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

- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and

- 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
 - C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
 - D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
 - E. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
 - F. *Effect of Engineer's Determination:* If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

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

7.08 *Permits*

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

7.09 *Taxes*

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

7.10 *Laws and Regulations*

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

7.11 *Record Documents*

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

7.12 *Safety and Protection*

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

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
 - C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
 - D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
 - E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
 - F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
 - G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

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

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

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

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements:*

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

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

1. *Shop Drawings:*

- a. Contractor shall submit the number of copies required in the Specifications.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review:*
 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
 5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

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

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.

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

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

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

8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

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

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

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

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

9.06 *Insurance*

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

9.07 *Change Orders*

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

9.08 *Inspections, Tests, and Approvals*

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

9.09 *Limitations on Owner's Responsibilities*

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

9.10 *Undisclosed Hazardous Environmental Condition*

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

9.11 *Evidence of Financial Arrangements*

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

9.12 *Safety Programs*

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

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

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

10.04 *Rejecting Defective Work*

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

10.05 *Shop Drawings, Change Orders and Payments*

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

10.06 *Determinations for Unit Price Work*

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

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

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

10.08 *Limitations on Engineer's Authority and Responsibilities*

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

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

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

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

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

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

11.02 *Owner-Authorized Changes in the Work*

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

11.03 *Unauthorized Changes in the Work*

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

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

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

ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
 - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation:*
 - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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

13.01 Cost of the Work

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

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

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
- 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

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

13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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

14.01 *Access to Work*

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

14.02 *Tests, Inspections, and Approvals*

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

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

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

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

14.04 *Acceptance of Defective Work*

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

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

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

14.06 *Owner May Stop the Work*

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

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

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

15.01 Progress Payments

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

- a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
 4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
 5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
 6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

- e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

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

E. *Reductions in Payment by Owner:*

- 1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - l. there are other items entitling Owner to a set off against the amount recommended.
- 2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

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

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
 - 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

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

15.06 *Final Payment*

- A. *Application for Payment:*
 - 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

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

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

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

16.03 *Owner May Terminate For Convenience*

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

16.04 *Contractor May Stop Work or Terminate*

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

expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

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

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

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

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Headings*

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

SECTION 00 73 00 - SUPPLEMENTARY CONDITIONS

GENERAL

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

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

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

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY*SC-1.01.A. Defined Terms*

Add new paragraph 1.01.A.49 and 1.01.A.50 immediately after paragraph 1.01.A.48 of the General Conditions which shall read as follows:

49. "Additional Insureds", except where otherwise expressly defined, shall mean:

Town of Wheatland
RQAW Corporation
Atlas Technical Consultants, LLC

ARTICLE 2 – PRELIMINARY MATTERS*SC-2.02 Copies of Documents*

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

Owner shall furnish to Contractor two (2) copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

ARTICLE 3 – DOCUMENT: INTENT, REQUIREMENTS, REUSE*SC-3.01 Intent*

SC-3.01.E. Add new Paragraph 3.01.E.1 immediately after Paragraph 3.01.E:

1. Engineer will issue, within five working days of receipt, such written clarifications or interpretations of the requirement of the Contract Documents (in a form as determined by Engineer) as Engineer may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. If Engineer determines, based upon the nature of the requested clarification or interpretation, that

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01 Commencement of Contract Times; Notice to Proceed

SC-4.01.A Delete Paragraph 4.01.A. in its entirety and insert the following new paragraph in its place:

- A. The Contract Times will commence 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 Agreement.

SC-4.04 Progress Schedule

SC-4.04.C And new Paragraph 4.04.C. immediately after Paragraph 4.04.B.:

- C. Provide an updated Progress Schedule with each Application for Payment. Engineer may deny Application for Payment if an updated Progress Schedule is not received.

SC-4.05 Delay's in Contractor's Progress

SC-4.05.A Delete Paragraph 4.05.A. in its entirety and insert the following new paragraph in its place:

- A. No claim for payment, compensation or adjustment of any kind (other than the extensions of time provided for herein) shall be made or asserted against the Owner or Engineer by the Provider for damages caused by hindrances or delays from any cause, whether such hindrances or delays be avoidable or unavoidable, and the Provider shall make no claim for damages by reason of any such hindrances or delays, and will accept in full satisfaction of such hindrances or delays an extension of time to complete the performance of the Work as specified.

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

SC-5.03 Subsurface and Physical Conditions

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

- C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:
 - 1. Report dated prepared by Atlas Technical Consultants, LLC., Indianapolis, IN
The report listed above is appended to the Contract Documents, but is not considered part of the Contract Documents. The Technical Data contained therein upon which the Contractor is entitled to rely as provided in Paragraph 5.03.B of the General Conditions and as identified and established above are incorporated therein by reference.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.01 Performance, Payment and Other Bonds

Add new paragraph 6.01.A.1. immediately after paragraph 6.01.A of the General Conditions which shall read as follows:

1. Contractor shall submit the Maintenance Bond within ten (10) days of acceptance of the project by the Owner, for an amount equal to ten percent (10%) of the final contract amount, guaranteeing for a period of one (1) year after the date of acceptance of the project by the Owner.

SC-6.02 Insurance—General Provisions

Add new paragraph 6.02.A.1. immediately after paragraph 6.02.A of the General Conditions which shall read as follows:

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

SC-6.03 Contractor’s Insurance

Add new paragraph 6.03.J immediately after paragraph 6.03.K of the General Conditions which shall read as follows:

- K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers’ Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:	<u>Statutory</u>
Federal, if applicable (e.g., Longshoreman’s):	<u>Statutory</u>
Employer’s Liability:	<u>\$1,000,000</u>
Foreign voluntary worker compensation	<u>Statutory</u>

2. Contractor’s Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions which shall include complete operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Provider:

General Aggregate	\$ <u>3,000,000</u>
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Products - Completed Operations Aggregate \$ 2,000,000

Each Occurrence (Bodily Injury and Property
 Damage) \$ 1,000,000

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

Bodily Injury:

Each person \$ 500,000

Each accident \$ 1,000,000

Property Damage:

Each accident \$ 1,000,000

Combined Single Limit of \$ 1,000,000

4. Excess or Umbrella Liability:

Per Occurrence \$ 1,000,000

General Aggregate \$ 3,000,000

5. Contractor’s Professional Liability:

Each Claim \$ 1,000,000

Annual Aggregate \$ 3,000,000

SC-6.04 Owner’s Liability Insurance

Delete Paragraphs 6.04.A and 6.04.B in their entirety and insert the following:

- A. Contractor shall purchase and maintain until the date of final acceptance, Owner’s and Contractor’s Protective Liability Insurance to protect Owner, including its employees, officers, and agents against claims which may arise from the operations of the Contractor, or his subcontractors. The coverage shall be for not less than the following amounts or greater where required by law or regulation:

Combination of Primary and Umbrella Coverage \$ 5,000,000

This insurance shall also cover the Engineer, RQAW Corporation, RQAW Corporation’s subconsultants or such other engineer or engineers as may act under the Contract, against similar claims.

- B. Not Used.

SC-6.05 Property Insurance

Delete Paragraphs 6.05.A.13 and 6.05.B in their entirety and insert the following:

13. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Not used.

ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

SC-7.01 Supervision and Superintendence

Add new paragraphs 7.01.C and 7.01.D immediately after paragraph 7.01.B of the General Conditions which shall read as follows:

- C. The Superintendent will be Contractor’s representative at the Site and shall have authority to act on behalf of the Contractor. All communications given to or received from the Superintendent shall be binding on Contractor.
- D. Prior to the Acceptance of Contractor’s Bid, the Owner will require Contractor to submit the identity and related experience of the Contractor’s proposed Superintendent and Project Management Personnel to better evaluate the Contractor’s past performance. Submitted information shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such individual. If Owner or Engineer, after due investigation, has objection to any proposed Personnel, Owner may, before the Notice of Award is given, request Contractor to submit a substitute, without an increase in the Bid Price. Any Personnel so listed and against which Owner or Engineer makes no written objection prior to the giving of Notice of Award will be deemed acceptable to Owner and Engineer. The Contractor’s proposed replacement of the Superintendent or Project Management Personnel shall also be subject to these requirements.

SC-7.02 Labor; Working Hours

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

1. Work Hours: Perform work between 7:00 a.m. and 6:00 p.m. Emergency work may be performed anytime without the Owner’s written consent required in paragraph 7.02.B.
2. Work After Hours: Night work may be established by Contractor as regular procedure with written consent of Owner. Such consent, however, may be revoked at any time by Owner if Contractor fails to maintain adequate equipment and supervision for proper prosecution and control of night work.
3. Owner’s legal holidays are New Years Day, Martin Luther King Day, Good Friday, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran’s Day, Thanksgiving Day, Day after Thanksgiving, Washington’s Birthday, and Christmas Day.

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

Contractor is responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer’s services (including those of the Resident Project Representative, if any), Owner’s representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as

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overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-7.08 Permits

SC 7.08 Add a new paragraph immediately after Paragraph 7.08.A:

- B. Prior to construction beginning, Owner will have obtained the following permits:
1. Indiana Department of Environmental Management - Application for Construction Permit for Public Water System.
 2. Indiana Department of Environmental Management – Construction Stormwater General Permit (CSGP).
 3. Indiana Department of Transportation (INDOT) – Right-of-way Permit(s).
 4. CSX Railroad Permit(s).

SC-7.09 Taxes

SC 7.09 Add a new paragraph immediately after Paragraph 7.09.A:

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

SC-7.10 Laws and Regulations

SC 7.10 Add a new paragraph immediately after Paragraph 7.10.C:

- D. Financing of the project will be through the State Revolving Fund administered by the Indiana Finance Authority.

SC-7.12 Safety and Protection

SC 7.12 Add the following new paragraphs 4., 5., 6., and 7. immediately after Paragraph 7.12.A.3.:

4. No Duty. The duty of the Owner or Engineer to observe Contractor's performance does not include any review of the adequacy of Contractor's safety measures in, on, or near the Work site or sites. Engineer has not been retained or compensated to provide design and construction review services relating to Contractor's safety precautions required for Contractor to perform the Work.

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5. No Liability. Neither the Owner, nor an official or employee of the Owner, nor the Engineer, or any authorized assistant or agent of any of them, shall be responsible for safety precautions and programs in connection with the Work or any liability arising therefrom.
6. Protection of Operations. The Contractor shall take all necessary precautions so as to cause no unauthorized interruption in any essential part of the distribution system operations. Shutdowns for construction Work shall be scheduled in advance (minimum 14 days notice), carefully planned, and shall be carried out in close cooperation with the Owner.
7. Special Requirements for Structural Design. All structures to be provided by the Contractor, that require structural design shall be designed and constructed under the observation of a structural engineer, registered in the State of Indiana, acting for and retained by the Contractor. Drawings and calculations for such structures shall be prepared and sealed by the structural engineer and submitted to the Engineer and Owner for record. A clear outline of the proposed construction procedure shall be shown on the drawings. A statement in writing by the structural engineer attesting that said engineer has visited the Work site or sites, that the design does satisfy the conditions as actually encountered and that the actual construction conforms to the drawings and calculations, as submitted, must be submitted to the Engineer before the Work related to such structures will be considered complete.

All temporary structures, including sheeting and bracing for excavations, that affect the safety of the public, workmen, inspectors, or Owner's or Engineer's personnel shall be regarded as structures that require structural design.

SC-7.16 Shop Drawings, Samples, and Other Submittals

SC 7.16 Delete paragraph 7.16.D.8. in its entirety and insert the following:

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

SC 7.16 Add the following new paragraph 9. immediately after Paragraph 7.16.D.8.:

9. Engineer, generally, will process shop drawings and return them to the Contractor in not more than 10 working days from day of receipt. If the nature of the shop drawings is such that the review cannot be completed in 10 working days, Engineer will advise the Contractor giving a schedule for performing the review.

ARTICLE 8 – OTHER WORK AT THE SITE*SC-8.02 Coordination*

SC-8.02 Add the following new Paragraph 8.02.C. immediately after Paragraph 8.02.B.:

- C. Should Contractor cause damage to the Work or property of any separate contractor at the site, or should any claim arising out of Contractor's performance of the Work at the site be made by any separate contractor against Contractor, Owner, Engineer, Engineer's Consultants, or any other person, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by arbitration or at law. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold Owner, Engineer, and Engineer's Consultants harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any separate contractor against Owner, Engineer, or Engineer's Consultants to the extent based on a claim arising out of Contractor's performance of the Work. Should a separate contractor cause damage to the Work or property of Contractor or should the performance of Work by any separate contractor at the site give rise to any other claim, Contractor shall not institute any action, legal, or equitable, against Owner, Engineer, or Engineer's Consultants or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Engineer, or Engineer's Consultants on account of any such damage or claim. If Contractor is delayed at any time in performing or furnishing Work by any act or neglect of a separate contractor and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a claim for an extension of times in accordance with Article 11. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Engineer, and Engineer's Consultants for any delay, disruption, interference, or hindrance caused by any separate contractor. This paragraph does not prevent recovery from Owner, Engineer, or Engineer's Consultants for activities that are their respective responsibilities.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION*SC-10.03 Project Representative*

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

- B. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.
1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall

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generally communicate with Owner only with the knowledge of and under
the direction of Engineer.

2. Liaison:
 - a. The RPR will generally serve as the Engineer’s liaison with Contractor. Working principally through Contractor’s authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner’s liaison with Contractor when Contractor’s operations affect Owner’s on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
3. Review of Work and Rejection of Defective Work:
 - a. Conduct on-Site observations of Contractor’s work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Report to Engineer whenever RPR believes that any part of Contractor’s work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
4. Inspections, Tests, and System Start-ups:
 - a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner’s personnel, and that Contractor maintains adequate records thereof.
 - b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.
5. Records:
 - a. Prepare a daily report or keep a diary or log book, recording Contractor’s hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

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- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
 - c. Maintain records for use in preparing Project documentation.
 6. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.
 7. Completion:
 - a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.
 - b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
 - c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.
- C. The RPR shall not:
 1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
 5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs regarding the activities or operations of Owner or Contractor.
 6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
 7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
 8. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK*SC-11.07 Execution of Change Orders*

SC 11.07.C Add the following new paragraph immediately after Paragraph 11.07.C.:

- D. After execution of a Change Order, Contractor shall update the Project Schedule and/or Schedule of Values to reflect the agreed upon changes in Contract Price and/or Contract Time.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK*SC-13.03 Unit Price Work*

SC 13.03.E Delete Paragraph 13.03.E in its entirety.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK*SC-14.02 Tests, Inspections, and Approvals*

SC 14.02.B Delete Paragraph 14.02.B. in its entirety and insert the following in its place:

- B. Contractor shall employ and pay for the services of an independent testing laboratory to perform all inspections, test or approvals required by the Contract Documents except as otherwise specifically provided in the Contract Documents.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD*SC-15.01 Progress Payments:*

SC 15.01.B Add the following new subparagraph to Paragraph 15.01.B.1.:

- a. Submit three copies of each application on a form approved by the Owner. Present required information in typewritten form or on electronic media printout.

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

4. Stored Materials - Individual items with value of not less than \$10,000 are eligible for payment by Owner as stored materials. Contractor may request payment of stored materials as approved by the Owner, submit a separate schedule for Materials Stored showing line item, description, previous value received, value incorporated into the work, and present value. Payment for stored materials is not guaranteed.

SC 15.01.C Add the following new Paragraph 15.01.C.7. immediately after Paragraph 15.01.C.6.:

7. Keep all record drawings up to date. Engineer's review and recommendation for payment to the Owner is subject to the Contractor maintaining all record drawings are in alignment with the progress of the Work.

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

1. Thirty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any

SC-15.03 Substantial Completion

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

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

ARTICLE 18 – MISCELLANEOUS

SC-18.09 Wage Rates

SC-18.09 Add the following new paragraph immediately after Paragraph 18.08.

18.09 Wage Rates

- A. Wage rates for the Work shall be not less than the prescribed United States Department of Labor rates attached as Exhibit A to these Supplementary Conditions, as modified and in effect on the effective date of the Agreement. Contractor may obtain the wage rates from the following website:

<https://www.wdol.gov/dba.aspx>

2. Browse All Determinations by State
3. Click on Indiana
4. Select Knox County – Heavy or Highway

SC-18.10 Suspension and Debarment

SC-18.10 Add the following new paragraph immediately after Paragraph 18.09.

18.10 Suspension and Debarment

- A. SRF materials regarding the Suspension and Debarment provision applicable to this project are attached as an exhibit to the Supplementary Conditions.

SC-18.11 Green Project Reserve

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

18.11 Green Project Reserve

- A. SRF materials regarding the Green Project Reserve applicable to this project are attached as an exhibit to the Supplementary Conditions.

SC-18.12 American Iron and Steel

SC-18.12 Add the following new paragraph immediately after Paragraph 18.11.

18.12 American Iron and Steel

- A. SRF materials regarding the American Iron and Steel provision applicable to this project are attached as an exhibit to the Supplementary Conditions.

SC-18.13 Disadvantaged Business Enterprise

SC-18.13 Add the following new paragraph immediately after Paragraph 18.12.

18.13 Disadvantaged Business Enterprise

- A. Take all necessary affirmative steps to assure that minority and women's business enterprises are used when possible. Affirmative steps shall include taking the following actions for all of these two (2) types of enterprises:
1. Placing qualified enterprises on solicitation lists;
 2. Assuring that these enterprises are solicited whenever they are potential sources.
 3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by these enterprises.
 4. Establishing delivery schedules, where the requirement permits, which encourage participation by these enterprises.
 5. Using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.
 6. Requiring each subcontractor to take the affirmative steps 1. through 5. above.

Disadvantaged Business Enterprise forms and guidance are attached as an exhibit to the Supplementary Conditions.

SC-18.14 Prohibition of Discrimination

SC-18.14 Add the following new paragraph immediately after Paragraph 18.13.

18.14 Prohibition of Discrimination

- B. The Contractor agrees:
1. That in the hiring of employees for the performance of work under this Contract or any subcontract hereunder, no contractor, or subcontractor, nor any person acting on behalf of such contractor or subcontractor, shall, by reason of race, religion, color, sex, national origin or ancestry, discriminate against any citizen of the State of Indiana who is qualified and available to perform the work to which the employment relates;
 2. That no contractor, subcontractor, or any person on his/her behalf shall in any manner, discriminate against or intimidate any employee hired for the performance of work under this Contract on account of race, religion, color, sex, national origin or ancestry;

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3. That there may be deducted from the amount payable to the Contractor under this Contract, a penalty of five dollars [\$5.00] for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the Contract; and
4. That this Contract may be cancelled or terminated by the Owner and all money due to become due hereunder may be forfeited, for a second or any subsequent violation of the terms or conditions of this section of the Contract.

SC-18.15 Severability

SC-18.15 Add the following new paragraph immediately after Paragraph 18.14.

18.15 Severability

- A. If any portion of the Contract Documents is invalid or unenforceable pursuant to applicable law, such portion shall be void in the jurisdiction where it is invalid or unenforceable, and the remainder of the Contract Documents shall remain binding upon the parties hereto.

SC-18.16 Compliance with E-Verify Program

SC-18.16 Add the following new paragraph immediately after Paragraph 18.15.

18.16 Compliance with E-Verify Program

- A. Pursuant to IC 22-5-1.7, Contractor shall enroll in and verify the work eligibility status of all newly hired employees of Contractor through the E-Verify Program (“Program”). Contractor is not required to verify the work eligibility status of all newly hired employees through the Program if the Program no longer exists.
- B. Contractor and its subcontractors shall not knowingly employ or contract with an unauthorized alien or retain an employee or contract with a person that Contractor or its subcontractor subsequently learns is an unauthorized alien. If Contractor violates this Section 18.16, Owner shall require Contractor to remedy the violation not later than thirty (30) days after Owner notifies Contractor. If Contractor fails to remedy the violation within the thirty (30) day period, Owner shall terminate the Contract for breach of contract. If Owner terminates the Contract, Contractor shall, in addition to any other contractual remedies, be liable to Owner for actual damages. There is a rebuttable presumption that Contractor did not knowingly employ an unauthorized alien if Contractor verified the work eligibility status of the employee through the Program.
- C. If Contractor employs or contracts with an unauthorized alien but Owner determines that terminating the Contract would be detrimental to the public interest of public property, Owner may allow the Contract to remain in effect until Owner procures a new contractor.
- D. Contractor shall, prior to performing any work, require each subcontractor to certify to Contractor that the subcontractor does not knowingly employ or contract with an unauthorized alien and has enrolled in the Program. Contractor shall maintain on file a certification from each subcontractor throughout the duration of the Project. If Contractor determines that a subcontractor is in violation of this Paragraph 18.16, Contractor may terminate its contract with the

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subcontractor for such violation. Such termination may not be considered a breach of contract by Contractor or the subcontractor.

- E. With the Agreement, Contractor shall submit executed affidavits stating they will not knowingly employ illegal aliens.
- F. Contractor's subcontractors shall, prior to performing any work, submit executed affidavits which state they will not knowingly employ illegal aliens.

SC-18.17 Engaging in Activities with Iran

SC-18.17 Add the following new paragraph immediately after Paragraph 18.16.

18.17 Engaging in Activities with Iran

- A. Pursuant to IC 5-22-16.5, Contractor shall not engage in investment activities in the country of Iran.

(NO TEXT FOR THIS PAGE)

EXHIBIT A

HUD 4010

Applicability

The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

A. 1. (i) Minimum Wages. 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 I(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 29 CFR 5.5(a)(1)(iv); 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 29 CFR 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 29 CFR 5.5(a)(1)(ii) 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.

(ii) (a) Any class of laborers or mechanics 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. HUD shall approve an additional classification and wage rate and fringe benefits therefor 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 HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140.)

(c) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii)(b) or (c) of this paragraph, 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. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. Withholding. HUD or its designee 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 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, HUD or its designee 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. HUD or its designee may, after written notice to the contractor, disburse such amounts withheld for and on account of the contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

3. (i) Payrolls and basic records. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work 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. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017.)

(ii) (a) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted 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 weekly transmittals. 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 Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> 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 HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee, 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 subparagraph 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 HUD or its designee. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149.)

(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 29 CFR 5.5 (a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), 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 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 subparagraph A.3.(ii)(b).

(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 subparagraph A.3.(i) available for inspection, copying, or transcription by authorized representatives of HUD or its designee 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, HUD or its designee 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 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 29 CFR Part 5 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 will insert in any subcontracts the clauses contained in subparagraphs 1 through 11 in this paragraph A and such other clauses as HUD or its designee may by appropriate instructions require, and a copy of the applicable prevailing wage decision, 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 this paragraph.

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 HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. (i) Certification of Eligibility. 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) or to be

awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(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) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, Section 1 01 0, Title 18, U.S.C., "Federal Housing Administration transactions", provides in part: "Whoever, for the purpose of . . . influencing in any way the action of such Administration..... makes, utters or publishes any statement knowing the same to be false..... shall be fined not more than \$5,000 or imprisoned not more than two years, or both."

11. Complaints, Proceedings, or Testimony by Employees. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

B. Contract Work Hours and Safety Standards Act. The provisions of this paragraph B are applicable where the amount of the prime contract exceeds \$100,000. 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 the individual is employed on such work to work in excess of 40 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 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (1) of this paragraph, 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 40 hours without payment of the overtime wages required by the clause set forth in subparagraph (1) of this paragraph.

(3) Withholding for unpaid wages and liquidated damages. HUD or its designee 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 contract, 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 subparagraph (2) of this paragraph.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (1) through (4) of this paragraph 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 subparagraphs (1) through (4) of this paragraph.

C. Health and Safety. The provisions of this paragraph C are applicable where the amount of the prime contract exceeds \$100,000.

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, (Public Law 91-54, 83 Stat 96). 40 USC 3701 et seq.

(3) The contractor shall include the provisions of this paragraph in every subcontract so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontractor as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

EXHIBIT B

WAGE RATES

"General Decision Number: IN20230006 01/06/2023

Superseded General Decision Number: IN20220006

State: Indiana

Construction Types: Heavy and Highway

Counties: Adams, Allen, Bartholomew, Benton, Blackford, Boone, Brown, Carroll, Cass, Clark, Clay, Clinton, Crawford, Daviess, Dearborn, Decatur, DeKalb, Delaware, Dubois, Elkhart, Fayette, Floyd, Fountain, Franklin, Fulton, Gibson, Grant, Greene, Hamilton, Hancock, Harrison, Hendricks, Henry, Howard, Huntington, Jackson, Jasper, Jay, Jefferson, Jennings, Johnson, Knox, Kosciusko, Lagrange, Lawrence, Madison, Marion, Marshall, Martin, Miami, Monroe, Montgomery, Morgan, Newton, Noble, Ohio, Orange, Owen, Parke, Perry, Pike, Posey, Pulaski, Putnam, Randolph, Ripley, Rush, Scott, Shelby, Spencer, Starke, Steuben, Sullivan, Switzerland, Tippecanoe, Tipton, Union, Vanderburgh, Vermillion, Vigo, Wabash, Warren, Warrick, Washington, Wayne, Wells, White and Whitley Counties in Indiana.

* EXCEPT LAKE, LAPORTE, PORTER AND ST. JOSEPH COUNTIES HEAVY AND HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the

Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number Publication Date
 0 01/06/2023

ASBE0008-004 03/01/2022

DEARBORN, FAYETTE, FRANKLIN, OHIO, RIPLEY SWITZERLAND AND UNION COUNTIES

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings & finishings to all types of mechanical systems).....	\$ 32.33	20.19
HAZARDOUS MATERIAL HANDLER (Includes preparation, wettings, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....	\$ 25.00	13.70

ASBE0017-008 06/01/2022		

NEWTON COUNTY:

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 52.80	32.30
HAZARDOUS MATERIAL HANDLER (INCLUDES PREPARATION, WETTING, STRIPPING REMOVAL SCRAPPING, VACUUMING, BAGGING AND DISPOSAL OF ALL INSULATION MATERIALS, WHETHER THEY CONTAIN ASBESTOS OR NOT, FROM MECHANICAL SYSTEMS).....	\$ 38.85	24.60

ASBE0018-005 06/01/2021		

BROWN, BARTHOLOMEW, BENTON, BOONE, CARROLL, CASS, CLAY, CLINTON, DECATUR, DELAWARE, ELKHART. FOUNTAIN, FULTON, GREENE, HAMILTON, HANCOCK, HENDRICKS, HENRY, HOWARD, JASPER, JOHNSON, KOSCIUSKO, LAGRANGE, MARSHALL, MADISON, MARION, MONROE, MONTGOMERY, MORGAN, OWEN, PARKE, PULASKI, PUTNAM, RUSH, SHELBY, STARKE, TIPPECANOE, TIPTON, VERMILLION, VIGO, WARREN and WHITE Counties

Rates Fringes

ASBESTOS WORKER/HEAT & FROST INSULATOR (includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....\$ 33.90	21.38
HAZARDOUS MATERIAL HANDLER (includes preparation, wettings, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....\$ 23.00	14.40

ASBE0037-004 04/02/2022

DAVISS, DUBOIS, GIBSON, KNOX, MARTIN, PIKE, POSEY, SPENCER,
SULLIVAN, VANDERBURGH AND WARRICK COUNTIES

	Rates	Fringes
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ASBESTOS WORKER/HEAT & FROST INSULATOR (includes application of all insulating materials protective coverings, coatings an finishes to all types of mechanical systems. Also the application of firestopping, material openings and penetrations in walls, floors, ceilings, curtain walls and all lead abatement.)...\$ 32.84	22.09
HAZARDOUS MATERIAL HANDLER (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....\$ 23.00	14.40

ASBE0041-002 07/01/2022

ADAMS, ALLEN, BLACKFORD, DE KALB, GRANT, HUNTINGTON, JAY,
MIAMI, NOBLE, STEUBEN, WABASH, WELLS AND WHITLEY COUNTIES:

	Rates	Fringes
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ASBESTOS WORKER/HEAT & FROST INSULATOR (includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....\$ 31.45	22.38
HAZARDOUS MATERIAL HANDLER (includes preparation, wettings, stripping, removal, scrapping, vaccuming, bagging	

& disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....\$ 23.00 14.40

ASBE0051-003 03/01/2022

CLARK, CRAWFORD, FLOYD, HARRISON, JACKSON, JEFFERSON, JENNINGS, LAWRENCE, ORANGE, PERRY, SCOTT, and WASHINGTON Counties

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 27.10	18.38
HAZARDOUS MATERIAL HANDLER (includes preparation, wettings, stripping, removal, scrapping, vaccuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....	\$ 19.80	13.30

ASBE0079-002 07/01/2017

RANDOLPH AND WAYNE COUNTIES

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes application of all insulating materials, protective coverings, coatings & finishings to all types of mechanical systems).....	\$ 22.25	8.89
HAZARDOUS MATERIAL HANDLER (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....	\$ 25.00	13.70

BRIN0003-001 06/01/2021

INDIANAPOLIS
BOONE, HANCOCK, HENDRICKS, JOHNSON, MARION, MONTGOMERY, MORGAN and SHELBY COUNTIES

	Rates	Fringes
Bricklayer, Stone Mason, Pointer, Caulking.....	\$ 33.59	15.89
TERRAZZO FINISHER.....	\$ 20.74	11.98
TERRAZZO WORKER/SETTER.....	\$ 33.36	15.74
Tile & Marble Finisher.....	\$ 21.69	11.99

Tile, Marble Setter.....\$ 32.61 15.73

BRIN0004-004 06/01/2021

FORT WAYNE
ADAMS, ALLEN, DEKALB, HUNTINGTON, NOBLE, STEUBEN, WELLS AND
WHITLEY COUNTIES:

	Rates	Fringes
BRICKLAYER (STONE MASON, MARBLE MASONS, POINTER, CLEANER, AND CAULKER).....	\$ 31.50	18.96
Terrazzo Grinder Finisher.....	\$ 28.00	14.84
Terrazzo Worker Mechanic.....	\$ 32.37	18.76
Tile Setter & Marble Mason Mechanic.....	\$ 28.00	16.36
Tile, Marble & Terrazzo Finisher.....	\$ 25.00	13.78

BRIN0004-005 06/01/2020

CRAWFORD, DUBOIS, PERRY, POSEY, SPENCER, VANDERBURGH, and
WARRICK Counties

	Rates	Fringes
BRICKLAYER.....	\$ 30.00	14.71
TILE FINISHER.....	\$ 20.31	12.00
TILE SETTER.....	\$ 27.19	13.85

BRIN0004-009 06/01/2021

BARTHOLOMEW, BROWN, DEARBORN, DECATUR, JENNINGS, MONROE, OHIO,
OWENS, RIPLEY and SWITZERLAND COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 30.53	15.95
TERRAZZO FINISHER.....	\$ 21.69	11.99
TERRAZZO WORKER/SETTER.....	\$ 33.36	15.74
Tile & Marble Finisher.....	\$ 21.69	11.99
Tile, Marble Setter.....	\$ 32.61	15.73

BRIN0004-010 06/01/2021

CLARK, FLOYD, and HARRISON Counties

	Rates	Fringes
BRICKLAYER BRICKLAYERS, STONEMASONS AND CEMENT MASONS.....	\$ 29.57	15.10

BRIN0004-015 06/01/2021

TERRE HAUTE
CLAY, DAVIESS, GIBSON, GREENE, KNOX, MARTIN, PARKE, PIKE,
PUTNAM, SULLIVAN, VERMILLION and VIGO COUNTIES

	Rates	Fringes
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BRICKLAYER

BRICKLAYERS, STONE MASONS
and POINTER/
CLEANER/CAULKER.....\$ 33.59

15.97

CEMENT MASON (Greene and
Sullivan Counties).....\$ 27.78

11.02

CEMENT MASON (REMAINING
COUNTIES).....\$ 33.59

15.97

TERRAZO FINISHER.....\$ 20.74

11.98

TERRAZO WORKER.....\$ 33.36

15.74

TILE LAYER, MARBLE MASON,

MOSAIC WORKER.....\$ 32.61

15.73

BRIN0004-016 06/01/2021

MUNCIE

BLACKFORD, DELAWARE, FAYETTE, FRANKLIN, HAMILTON, HENRY, JAY,
MADISON, RANDOLPH, RUSH, TIPTON, UNION and WAYNE COUNTIES

Rates Fringes

Bricklayer, Stonemason,
Pointer, Caulker & Cleaner.....\$ 31.75

18.07

TERRAZO FINISHER.....\$ 20.74

11.98

TERRAZO WORKER/SETTER.....\$ 33.36

15.74

Tile & Marble Finisher.....\$ 20.74

11.98

Tile & Marble Setter; Mosaic
Worker.....\$ 32.61

15.73

BRIN0006-001 06/01/2021

JASPER, NEWTON & STARKE COUNTIES

Rates Fringes

BRICKLAYER (Including
Stonemason, and Pointer,
Caulker & Cleaner).....\$ 38.85

27.17

Tile, Marble & Terrazzo Worker...\$ 37.05

21.64

BRIN0011-001 06/01/2021

LAFAYETTE

BENTON, CARROLL, CLINTON, FOUNTAIN, TIPPECANOE, WARREN and
WHITE COUNTIES

Rates Fringes

Bricklayer, Stonemason,
Pointer, Caulker & Cleaner.....\$ 30.75

18.97

TERRAZO FINISHER.....\$ 21.69

11.99

TERRAZO WORKER/SETTER.....\$ 33.36

15.74

Tile & Marble Finisher.....\$ 21.69

11.99

Tile & Marble Setter; Mosaic
Worker.....\$ 32.61

15.73

BRIN0018-002 06/01/2021

CASS, ELKHART, FULTON, GRANT, HOWARD, KOSCUISKO, LAGRANGE,
MARSHALL, MIAMI, PULASKI, WABASH

	Rates	Fringes
Bricklayer, Caulker, Cleaner, Pointer.....	\$ 31.11	18.40

CARP0002-023 04/01/2022		

DEARBORN, JACKSON, JENNINGS, OHIO, RIPLEY AND SWITZERLAND
COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 26.95	26.11

CARP0133-001 04/01/2021		

BOONE, CLAY, FOUNTAIN, MONROE, MONTGOMERY, MORGAN, OWEN,
PARKE, PUTNAM, VERMILLION AND VIGO COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 28.71	23.36

CARP0133-003 04/01/2021		

HAMILTON, HANCOCK, HENDRICKS, JOHNSON (Townships of Clark, Camp
Atterbury north of Hospital Road, Pleasant, White River), and
MARION Counties

	Rates	Fringes
CARPENTER.....	\$ 29.82	23.36

CARP0175-004 04/01/2021		

CLARK, FLOYD, HARRISON, JEFFERSON, SCOTT AND WASHINGTON COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 25.82	25.59

CARP0215-002 04/01/2022		

BENTON, CARROLL, CLINTON, PULASKI, TIPPECANOE, WARREN AND WHITE
COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 30.53	23.04

CARP0224-011 04/01/2021		

CRAWFORD, DUBOIS, PERRY, PIKE, POSEY, SPENCER, VANDERBURGH AND
WARRICK COUNTIES:

	Rates	Fringes
CARPENTER.....	\$ 25.89	25.52

CARP0224-012 04/01/2021		

DAVIESS, GIBSON, GREENE, KNOX, LAWRENCE, MARTIN, ORANGE AND SULLIVAN COUNTIES:

	Rates	Fringes
CARPENTER.....	\$ 26.24	25.57

CARP0232-003 04/01/2022		

ALLEN, DEKALB, LAGRANGE, NOBLE, STEUBEN and WHITLEY COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 29.14	23.87

CARP0301-001 04/01/2022		

BARTHOLOMEW, BROWN, (Camp Atterbury south of Hospital Road), DECATUR, FRANKLIN, JOHNSON (Townships of Blue River, Franklin, Hensley, Needham, Nineveh, Union) , RUSH AND SHELBY COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 29.26	23.87

CARP0413-003 04/01/2022		

ADAMS, CASS, ELKHART, FULTON, GRANT, HOWARD, HUNTINGTON, KOSCIUSKO, MARSHALL, MIAMI, TIPTON, WABASH AND WELLS COUNTIES:

	Rates	Fringes
CARPENTER.....	\$ 29.46	23.70

CARP0999-001 06/01/2017		

JASPER, NEWTON, AND STARKE COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 37.56	26.42

CARP1016-001 04/01/2022		

BLACKFORD, DELAWARE, FAYETTE, HENRY, JAY, MADISON, RANDOLPH, UNION AND WAYNE COUNTIES

	Rates	Fringes
CARPENTER.....	\$ 29.56	24.01

CARP1076-004 04/01/2016		

HAMILTON and MARION Counties, and the following Townships in JOHNSON County: Camp Atterbury (North of Hospital Rd.), Clark, Pleasant, and White River

Rates	Fringes
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MILLWRIGHT.....\$ 26.81 19.28

CARP1076-005 06/01/2017

JASPER, NEWTON, PULASKI, and STARKE Counties

Rates Fringes

MILLWRIGHT.....\$ 37.66 26.42

CARP1076-006 06/01/2018

BARTHOLOMEW, BLACKFORD, BOONE, BROWN, CLAY, DECATUR, DELAWARE,
FAYETTE, FOUNTAIN, FRANKLIN, HAMILTON, HANCOCK, HENDRICKS,
HENRY, JAY, JOHNSON, MADISON, MARION, MONROE, MONTGOMERY,
MORGAN, OWEN, PARKE, PUTNAM, RANDOLPH, RUSH, SHELBY, UNION,
VERMILLION, VIGO, AND WAYNE COUNTIES

Rates Fringes

MILLWRIGHT.....\$ 28.18 22.39

CARP1080-001 04/01/2021

GIBSON, GREENE, POSEY, SULLIVAN, VANDERBURGH and WARRICK
COUNTIES

Rates Fringes

MILLWRIGHT

ZONE 1

POSEY, VANDERBURGH and
WARRICK COUNTIES.....\$ 30.92 24.83

ZONE 2

GIBSON, GREENE AND
SULLIVAN COUNTIES.....\$ 29.64 25.77

ELEC0016-003 04/01/2022

CRAWFORD, DAVIESS, DUBOIS, GIBSON, LAWRENCE, MARTIN, ORANGE,
PERRY, PIKE, POSEY, SPENCER, VANDERBURGH, WARRICK

Rates Fringes

ELECTRICIAN.....\$ 40.88 18.62

ELEC0016-006 08/31/2020

CRAWFORD, DAVIESS, DUBOIS, GIBSON, LAWRENCE, MARTIN, ORANGE,
PERRY, PIKE, POSEY, SPENCER, VANDERBURGH, WARRICK

Rates Fringes

ELECTRICIAN (Communication
Technician Only).....\$ 29.15 15.40

ELEC0071-006 01/02/2019

DEARBORN, OHIO, and SWITZERLAND COUNTIES

Rates Fringes

Line Construction:

Equipment Operator.....	\$ 33.62	13.46
Groundman.....	\$ 24.17	11.38
Lineman & Cable Splicers....	\$ 38.27	14.48

ELEC0153-003 06/01/2021

ELKHART, KOSCIUSKO and MARSHALL COUNTIES

	Rates	Fringes
Communication Technician.....	\$ 26.50	18.33
ELECTRICIAN.....	\$ 36.50	25.98

Includes the installation, operation, inspection, modification, maintenance and repair of systems used for the transmission and reception of signals of any nature, for any purpose, including but not limited to , sound and voice transmission/transference systems, communication systems that transmit or receive information and /or control systems, television and video systems, micre-processor controlled fire alarm systems, and security systems and the performance of any task directly related to such installation or service. The scope of work shall exclude the installation of electrical power wiring and the installation of conduit raceways exceeding fifteen (15) feet in length.

ELEC0212-002 11/30/2021

DEARBORN, OHIO, and SWITZERLAND COUNTIES

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 25.95	12.27

ELEC0212-009 06/07/2022

DEARBORN, OHIO, and SWITZERLAND COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 33.29	20.05

ELEC0305-003 05/01/2022

ADAMS, ALLEN, DE KALB, HUNTINGTON, LAGRANGE, NOBLE, STEUBEN, WELLS, and WHITLEY COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 35.71	10.14+26.14%

ELEC0305-004 08/31/2020

ADAMS, ALLEN, DE KALB, HUNTINGTON, LAGRANGE, NOBLE, STEUBEN, WELLS, and WHITLEY COUNTIES

	Rates	Fringes
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ELECTRICIAN (Communication
Technician Only).....\$ 29.25 16.85

ELEC0369-005 05/31/2021

CLARK, FLOYD, HARRISON, JACKSON, JEFFERSON, SCOTT, and
WASHINGTON Counties

	Rates	Fringes
ELECTRICIAN.....	\$ 33.85	18.72

ELEC0481-003 03/31/2022

BARTHOLOMEW, BOONE, DECATUR, HAMILTON, HANCOCK, HENDRICKS,
JENNINGS, JOHNSON, MADISON, MARION, MONTGOMERY, MORGAN, PUTNAM,
RIPLEY, RUSH AND SHELBY COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 38.20	25.56

ELEC0481-004 01/01/2022

BARTHOLOMEW, BOONE, DECATUR, HAMILTON, HANCOCK, HENDRICKS,
JENNINGS, JOHNSON, MADISON, MARION, MONTGOMERY, MORGAN, PUTNAM,
RIPLEY, RUSH AND SHELBY COUNTIES

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 33.83	17.32

ELEC0531-002 05/31/2021

JASPER, PULASKI, and STARKE COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 41.50	28.26

ELEC0531-003 05/28/2018

JASPER, PULASKI, and STARKE COUNTIES

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 27.64	13.23

ELEC0538-005 01/01/2022

FOUNTAIN, VERMILLION, and WARREN Counties

	Rates	Fringes
ELECTRICIAN.....	\$ 37.80	22.66

ELEC0538-009 09/01/2018

FOUNTAIN, VERMILLION, and WARREN Counties

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 32.82	16.28

ELEC0668-001 06/01/2019		

BENTON, CARROLL, CASS, FULTON, TIPPECANOE and WHITE COUNTIES

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 28.90	14.53

ELEC0668-002 01/01/2022		

BENTON, CARROLL, CASS, FULTON, TIPPECANOE and WHITE COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 36.17	21.40

FOOTNOTE: a. PAID HOLIDAYS: New Years Day, Memorial Day, July 4th, Labor Day, Veterans Day Thanksgiving Day and Christmas Day

ELEC0697-003 08/31/2022

NEWTON COUNTY

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 37.15	28.77

ELEC0697-006 06/01/2022		

NEWTON COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 45.25	30.13

ELEC0702-003 12/30/2019		

DUBOIS, GIBSON, PERRY, PIKE, POSEY, SPENCER AND VANDERBURGH COUNTIES

	Rates	Fringes
Line Construction:		
GROUNDMAN, Class A.....	\$ 28.58	29% + 7.75
GROUNDMAN-EQUIPMENT OPERATOR (All other equipment).....	\$ 36.35	29% + 7.75
HEAVY-EQUIPMENT OPERATOR (All crawler type equipment D-4 and larger)...	\$ 41.49	29% + 7.75
LINEMAN.....	\$ 50.63	29% + 7.75

ELEC0725-007 06/01/2022		

BROWN, CLAY, GREENE, KNOX, MONROE, OWEN, PARKE, SULLIVAN AND

VIGO COUNTIES

	Rates	Fringes
Communication Technician.....	\$ 30.00	18.07

Includes the installation, operation, inspection, maintenance, repair and service of radio, television, recording, voice sound and vision production and reproduction apparatus, equipment and appliances used for domestic, commercial, education, entertainment and private telephone systems.

 ELEC0725-014 10/01/2022

BROWN, CLAY, GREENE, KNOX, MONROW, OWEN, PARKE, SULLIVAN AND VIGO COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 40.00	21.96

 ELEC0855-002 06/01/2018

BLACKFORD, DELAWARE, FAYETTE, FRANKLIN, HENRY, JAY, RANDOLPH, UNION and WAYNE Counties

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 27.64	14.15

 ELEC0855-004 06/01/2022

BLACKFORD, DELAWARE, FAYETTE, FRANKLIN, HENRY, JAY, RANDOLPH, UNION and WAYNE Counties

	Rates	Fringes
ELECTRICIAN.....	\$ 34.77	19.18

 ELEC0873-001 06/01/2021

CLINTON, GRANT, HOWARD, MIAMI, TIPTON, AND WABASH COUNTIES

	Rates	Fringes
ELECTRICIAN (Communication Technician Only).....	\$ 30.08	17.23

 ELEC0873-002 03/01/2022

CLINTON, GRANT, HOWARD, MIAMI, TIPTON AND WABASH COUNTIES:

	Rates	Fringes
ELECTRICIAN.....	\$ 36.59	20.12

 ELEC1393-001 12/02/2020

REMAINING COUNTIES

	Rates	Fringes
Line Construction:		
EQUIPMENT OPERATOR 1:		
Diggers, 5th wheel type		
trucks, crawler type, D-4		
and smaller, bucket trucks		
and live boom type line		
trucks.....	\$ 32.91	29%+6.75
EQUIPMENT OPERATOR 3		
(Backhoes over 1/2 yard		
bucket capacity, cranes		
rated at 15 ton or more		
capacity) 95% J.L. rate.....	\$ 39.19	29%+6.75
GROUNDMAN TRUCK DRIVER.....	\$ 26.14	29%+6.75
GROUNDMAN.....	\$ 25.04	29%+6.75
LINEMAN.....	\$ 41.61	29%+6.75

 ENGI0103-003 04/01/2021

INCLUDING UNDERGROUND AND UTILITY CONSTRUCTION

ADAMS, ALLEN, BENTON, BLACKFORD, CARROLL, CASS, CLINTON,
 DEKALB, DELAWARE, FAYETTE, GRANT, HAMILTON, HANCOCK, HENRY,
 HOWARD, HUNTINGTON, JAY, JOHNSON, MADISON, MARION, MIAMI,
 RANDOLPH, RUSH, SHELBY, STEUBEN, TIPPECANOE, TIPTON, UNION,
 WABASH, WAYNE, WELLS, WHITE AND WHITLEY COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1.....	\$ 37.75	20.21
GROUP 2.....	\$ 36.03	20.21
GROUP 3.....	\$ 35.11	20.21
GROUP 4.....	\$ 33.61	20.21

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Air compressors in manifold with throttle valve;
 Asphalt plant engineer; Auto grade or similar type machine;
 Auto patrol; Backhoe or farm-type tractor, 45 hp and over;
 Ballast regulator (RR); Bituminous mixer; Bituminous paver;
 Bituminous plant engineer; Bulldozer; Caisson drilling
 machine; Cherry picker, 15 ton or over; Chip spreader;
 Concrete mixer 21 cu. ft. or over; Core drilling machine;
 Crane or derrick with any attachment (including clamshell,
 dragline, shovel, backhoe, etc.); Dredge engineer; Dredge
 operator; Drilling machine on which the drill is an integral
 part; Earth mover, rubber-tired (paddle wheel, 616, 631,
 TS-24 or similar type); Earth mover, rubber-tired, tandem
 (\$0.50 per hour additional for each bowl); Elevating
 grader; Fork lift, 10 ton or over; P.C.C. formless paver
 post driver; Highlift shovel, 1 1/2 cu. yd. or over; Hoist,
 2 drums and over; Helicopter, crew; Hydraulic boom truck;
 keystone, skimmer scoop; Loader, self-propelled (belt,
 chain, wheel); Locomotive operator; Mechanic; Mucking
 machine; Panel board concrete plant, central mix type;
 Paver, Hetherington; Pile driver, skid or crawler; Road
 paving mixer; Rock breaking plant; Rock crushing plant,
 portable; Roller (asphalt, waterbound macadam, bituminous
 macadam, brick surface); Roller with dozer blade; Root
 rake, tractor-mounted; Self-propelled widener; Stump

remover, tractor-mounted; Surface heater and planer; Tandem push tractor (\$0.50 per hour additional); Tractor, boom; Winch or hoe head; Tractor, push; Tractor with scoop; Tractor-mounted spreader; Tree mover; Trench machine, over 24"; Tug boat operator; Well drilling machine; Winch truck with A-frame

GROUP 2: Air compressor with throttle valve or clever brooks-type combination; Backfiller; Backhoe on farm-type tractor, under 45 hp; Bull float; Cherry picker under 15 ton; Chip spreader, self-propelled; Concrete pump; Concrete mesh depressor, independently operated; Concrete spreader, power-driven; End loader under 1 1/2 cu. yd.; Excavating loader, portable; Finishing machine and bull float; Guniting machine; Head greaser; Mesh or steel placer; Multiple tamping machine (RR); P.C.C. concrete belt placer; Pull grader, power control; Refrigerating machine, freezing operation; Ross carrier; Sheepfoot roller (self-propelled); Tamper (multiple vibrating, asphalt, waterbound macadam, bituminous macadam, brick surface); Trench machine, 24" and under; Tube float; Welder

GROUP 3: Assistant plant engineer; Base paver (Jersey or similar type machine); Concrete finishing machine; Concrete mixer, less than 21 cu. ft.; Curb machine; Farm tractor, including farm tractor with all attachments except backhoe and including high lift end loaders of 1 cu. yd. capacity or less; Fire tender on boiler; Hoist, 1 drum; Operator, 5 pieces of minor equipment; Paving breaker; Power broom, self-propelled; Roller, earth and sub-base material; Slurry seal machine; Spike machine (RR); Tamper (multiple vibrating, earth and sub-base material); Throttle valve and fire tender combination on horizontal or upright boiler; Tractaire with drill; Tractor, 50 h.p. or over; Well point system; Widener, APSCO or similar type

GROUP 4: Air compressor; Assistant to engineer, oiler; Automatic dry batch plant; Bituminous distributor; Bituminous patching tamper; Belt spreader; Broom and belt machine; Chair cart, self-propelled; Coleman-type screen; Conveyor, portable; Digger post hole, power-driven; Fork lift, under 10 ton; Form grader; Form tamper, motor-driven; Generator; Hetherington driver; Hydra seeder; Operator, 1 through 4 pieces of minor equipment; Outboard or inboard motor boat; Power curing spraying machine; Power saw, concrete, power-driven; Pug mill; Pull broom, power-type; Seaman tiller; Straw blower or brush mulcher; Striping machine paint, motor-driven; Sub grader; Tractaire, tractor, below 50 h.p.; Truck crane oiler, driver; Spreader; Water pump; Welding machine, 2 of 300 amps or over

 ENGI0150-009 04/01/2022

HEAVY, HIGHWAY AND RAILROAD CONSTRUCTION

ELKHART, FULTON, JASPER, KOSCIUSKO, LAGRANGE, MARSHALL, NEWTON, NOBLE, PULASKI, and STARKE COUNTIES

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 32.85	32.30
GROUP 2.....	\$ 31.25	32.30

GROUP 3.....	\$ 29.95	32.30
GROUP 4.....	\$ 28.55	32.30
GROUP 5.....	\$ 24.30	30.85

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Air compressors in manifold with throttle valve; Asphalt plant engineer; Auto grade or similar type machine; Auto patrol; Automatic Sub-Grade; Backhoe or farm type tractor, 45 hp and over; Ballast regulator (RR); Barrier Wall Machine; Batch Plants (Concrete & Asphalt); Bituminous mixer; Bituminous paver; Bituminous plant engineer; Boring Machine; Bulldozer; Caisson drilling machine; Cherry picker, 15 ton or over; Chip spreader; Concrete mixer, 21 cu. ft. or over; Concrete Belt Placer; Concrete Paver; Concrete Pump (Truck Mounted); Concrete Saw (track mounted); Concrete Spreader (power driven); Core drilling machine; Crane or derrick with any attachment (including clamshell, dragline, shovel, backhoe, etc.); Curb Machine; Gutter Machine; Dredge engineer; Dredge operator; Drilling machine on which the drill is an integral part; Earthmover, rubber-tired (paddle wheel, 616, 631, TS-24 or similar type); Earthmover, rubber-tired, tandem (.50 per hr. additional for each bowl); Elevating Grader; Forklift (10 ton or over); P.C.C. Formless Paver; Gradall; Gravel Processing Plant (portable); Operator of Guard Rail Post Driver; Highlift Shovel 1-1/2 cu.yd. or over) Frame; Hoist (2 drum & over); Helicopter crew; Hydraulic boom truck; Hydraulic Excavator; Loaded-Self propelled (belt chain wheel); Laser Screed; Locomotive operator; Mechanic; Mucking machine; P.C.C. Concrete Belt Placer; Panel board concrete plant (central mix type); Paver (Hetherington); Pavement Breaker; Pile driver, skid or crawler; Road paving mixer; Rock breaking plant; Rock crushing plant (portable); Roller (asphalt, waterbound macadam, bituminous macadam, brick surface); Roller with dozer blade; Road Widener; Root rake (tractor-mounted); Roto Mill Grinder; Self-propelled widener; Stump remover; Surface heater and planer; Tandem push tractor (\$0.50 per hour additional); Tractor, boom; Winch or hoe head; Tractor (push); Tractor with scoop; Tractor-mounted spreader; Tree mover; Trench machine, over 24"; Tug boat operator; Well drilling machine; Widener (Apsco or similar type); Winch truck with A-frame

GROUP 2: Air compressor with throttle valve or Clever Brooks type combination; Backfiller; Farm type tractor (under 45 H.P.); Cherry picker under 15 ton; Chip spreader (self-propelled); Concrete pump (trailer type); Concrete mesh depressor, independently operated; End loader under 1 1/2 cu. yd.; Excavating loader (portable); Finishing machine and bull float; Guniting machine; Hydraulic Power unit; Head greaser; Mesh or steel placer; Multiple tamping backhoe on machine (RR); Bull float (bidwell Machine); Refrigerating machine-operation; Ross Carrier; Sheepfoot roller (self-propelled); Tamper-Multiple Vibrating (Asphalt, Waterbound, Macadam, Bituminous Macadam, Brick Surface); Trench machine (24" and under); Tube float; Water Pull/Wagon; Welder

GROUP 3: Plant engineer; Base paver (Jersey or similar type machine); Concrete finishing machine; Concrete mixer, less than 21 cu. ft.; Curb machine; Farm tractor, including farm tractor with all attachments except backhoe and including high lift end loaders of 1 cu. yd. capacity or less;

Fireman, on boiler; Hoist, 1 drum; Operator, 3-5 pieces of minor equipment; Paving breaker; Power broom, self-propelled; Roller, earth and sub-base material; Power Saw-Concrete (Power Driven); Slurry seal machine; Spike machine (RR); Sub-surface Material Distributor; Tamper (multiple vibrating, earth and sub-base material); Throttle valve; Throttle Valve and fireman combination on horizontal or upright boiler; Tractaire with drill; Well Point

GROUP 4: Air compressor; Assistant to engineer, oiler; Bituminous patching tamper; Belt spreader; Broom and belt machine; Chair cart, self-propelled; Coleman-type screen; Conveyor, portable; Deck-hand Digger post hole, power-driven; Forklift, under 10 ton; Form grader; Form tamper, motor-driven; Generator; Hetherington driver; Hydra seeder; Mechanic heater; Operator, 2 pieces of minor equipment; Outboard or inboard motor boat; Power curing spraying machine; Pug mill; Pull broom, power type; Seaman tiller; Skid steer loader over 3/4 cu. yd.; Straw blower or brush mulcher; Striping machine paint, motor-driven; Sub-grader; Tractaire; Tractor, below 50 h.p.; Truck crane oiler; Spreader; Water pump

GROUP 5: Skid steer loader under 3/4 cu. yds

 ENGI0150-039 06/01/2021

UNDERGROUND & UTILITY CONSTRUCTION:

JASPER, NEWTON, PULASKI AND STARKE COUNTIES:

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 42.00	39.68
GROUP 2.....	\$ 41.20	39.68
GROUP 3.....	\$ 36.90	39.68
GROUP 4.....	\$ 34.70	39.68
GROUP 5.....	\$ 29.25	39.68

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Asphalt plants (construction), Asphalt plant (permanent), Auto Patrol (Maintainer), Automatic Dry Batch Plant, Automated Concrete Placer, Automated Sub-Grader, Automated Slip Form Paver, Automated Finish Machine, Combination Backhoe Front, End Loader Machine (1/2 cu. yd.), Backhoe bucket or over or with attachments), Combination backhoe 1 cu yd, Backhoe bucket or over or with attachments, Ballast Regulator (RR), Belt Loader (stationary), Boring Machine (road), Bulldozer, Concrete Mixer(27 cu. ft. or over), Concrete Pump (truck mounted), Concrete Breaker (truck mounted and self-propelled), Core Drilling Machine, Cranes and Backhoes (all attachments), Cranes, Hammerhead, Creter Crane, Crushers (concrete, rock, recycling, etc.), Derricks , Derricks (traveling), Dredge Operator, Formless Curb and Gutter Machine (36 inches and over), Formless Curb and Gutter Machine under 36 inches, Gradall and Machines (of a like nature), Guardrail Post Driver (truck mounted), Lead Greaser, Helicopter, Highlift Shovel (3 yd. and over), Hoist (1 drum), Hoist (2, and 3 drums), Hydraulic Power Units (grouting, piledriving and extracting) Hydro or water blaster (self-propelled), Locomotive Operators, Mechanic, Welder, Mucking Machine,

Panelboard Concrete Plant (central mix type), Paver (Hetherington), Pile Driver (Skid or Crawler), Road Paving Mixer, Rock Drill Crawler or Skid Rig, Rock Drill (truck Mounted), Ross Carrier, Roto Mill Grinder (36" and over), Roto mill grinder (less than 36"), Throttle Valve and Compressor or Clever Brooks Type Combination, Throttle Valve and Fireman Combination or Horizontal or Upright Boiler, Tournapull or similar type equipment, Tractor (boom), Tractor Drawn Belt Loader with attached Pusher (requires two engineers), Trench Machine, Tug Boat Operator, Wheel Excavator, Winch Tractor with "a" frame, Scoops, Turnapull or similar types machine used in Tandem (add \$1.00 to class 1 hourly rate for each machine attached there to).

GROUP 2: Combination Backhoe Front End Loader Machine with less than 1/2 cu. yd., Backhoe Bucket or with attachments, Bituminous Mixer, Bituminous Paver, Bridge Deck Finisher, Concrete Mixer (less than 27 cu. ft.), Compressor and throttle valve, Compressor (common receiver 3), Greaser, Highlift Shovels (under 3 cu. yds.), Jersey Spreader or Base Paver, Pavement Bump Grinder (self-propelled), Roller (Asphalt, waterbound, Macadam, Bituminous Macadam, Brick Surface, Sheepfoot Roller (self-propelled with blade), Surface Heater and Planer, Tamper (multiple vibrating, asphalt waterbound macadam, bituminous macadam, brick surface), Tractor (push), Tractor with scoop, Widener, Apsco or similar type.

GROUP 3: Back Filler, Bituminous Distributor, Broom and Belt Machine, Bull Float, Compressor (common receiver 2), Concrete cutter wheel type (rockwell), Concrete Finishing Machine, Concrete Spreader (power driven), Digger, Post Hole (power driven), Finishing Machine and Bull Float, Forklift, Form Grader, Form Tamper (motor driven), Hydraulic (boom truck) when used for hauling materials, Laser screed, Multiple Tamping Machine, Paving Breaker, Roller (earth and subbase material), Roller sheepfoot (self-propelled), Sub-grader, Tamper, Multiple Vibrating (earth and subbase material), Tractaire with Drill, Tractor (with all drawn attachments except backhoe and including Highlift, Endloader of 1 cu. yd. capacity and less.

GROUP 4: Air Compressors, Conveyor (all), Fireman on Boiler, Generator, Grout Machine, Power curing Spraying Machine (self-propelled), Broom (self-propelled), Seaman Tiller, Skid steer loaders, Spike Machine (RR), Stripping Machine (paint, self-propelled), Throttle Valve, Welding Machine, Well Points System.

GROUP 5: Deck Hand, Hetherington Driver, Mechanical Heater (1 to 5), Outboard or Inboard Motor Boat, Oiler, Power Saw (Concrete Power Driven), Water Pump, Grasscutter.

ENGI0181-014 04/01/2022

HEAVY AND HIGHWAY CONSTRUCTION:

BARTHOLOMEW, BROWN, CLARK, CRAWFORD, DEARBORN, DECATUR, DUBOIS, FLOYD, FRANKLIN, GIBSON, HARRISON, JACKSON, JEFFERSON, JENNINGS, LAWRENCE, MARTIN, OHIO, ORANGE, PERRY, PIKE, POSEY, RIPLEY, SCOTT, SPENCER, SWITZERLAND, VANDERBURGH, WARRICK, and WASHINGTON COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP A.....	\$ 39.50	18.56
GROUP B.....	\$ 36.85	18.56
GROUP C.....	\$ 34.72	18.56

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP A: Air compressor in manifold with throttle valve; Asphalt plant engineer; Auto grade or similar type machine; Bituminous mixer; Bituminous paver; Bituminous plant engineer; Bulldozer; Caisson drilling machine; Cherry picker, all; Ballast regulator (RR); Chip spreader, self-propelled; Cold grinder or similar type equipment; Concrete mixer, 21 cu. ft. or over; Concrete pump, truck-mounted; Core drilling machine; Crane or derrick with any attachment (including clamshell, dragline, shovel, backhoe, etc.); Dredge operator; Drilling machine on which the drill is an integral part; Earth mover, rubber-tired, tandem 0.50 per hour additional; Elevating grader; Endloader, Hi- lift shovel; P.C.C. formless paver; Gradall; Gravel processing plant, portable; Guardrail post driver operator; Head greaser; Hi-lift shovel, endloader; Hoist (2 drums and over); Helicopter crew; Hydraulic boom truck, Keystone, Skimmer Scoop; Loader, self-propelled (belt, chain wheel); Locomotive operator; Mechanic; Mucking machine; Multi-bank drill operator; Panel board concrete plant, central mix type; Paver, Hetherington; Pile driver, skid or crawler; Road paving mixer; Rock breaking plant; Rock crushing plant, portable; Roller (asphalt, waterbound, macadam, bituminous macadam, brick surface); Roller, with dozer blade; Root rake, tractor-mounted; Stump remover, tractor- mounted; Surface heater and planer; Tandem push tractor, \$0.50 per hour additional; Tractor, boom winch or hoe head; Tractor, push; Tractor with scoop; Tractor-mounted spreader; Tree mover; Trench machine, over 24"; Tug boat operator; Welder; Well drilling machine; Self-propelled widener.

GROUP B: Air compressor with throttle valve or clever brooks-type combination; Backfiller, base paver, Jersey or similar type machine; Bull float; Concrete finishing machine; Concrete mesh depressor, independently operated; Concrete spreader, power- driven; Dredge engineer; Excavator loader, portable; Fire tender on boiler; Forklift, regardless of ton; Hoists, 1 drum; Mesh or steel placer; Minor equipment operator, 5 pieces; Multiple tamping machine (RR); P.C.C. concrete placer; Paving breaker; Power broom, self-propelled; Pull grader, power-controlled; Refrigerating machine, freezing operation; Roller, earth and sub- base material; Ross carrier (Straddle buggy); Sheepfoot roller, self-propelled without blade; Tamper, multiple\vibrating (asphalt, waterbound macadam, bituminous macadam, brick surface); Tamper, multiple vibrating (earth and sub-base material); Trench machine, 24" and under; Tube float; Well point system; Widener, Apsco or similar type; Winch truck with A-frame.

GROUP C: Air compressor, oiler; Automatic dry batch plant; Bituminous distributor; Bituminous patching tamper; Belt spreader; Broom and belt machine; Brush burner; Chair cart, self- propelled; Coleman-type screen; Cold grinder oiler;

Concrete mixer, less than 21 cu. ft.; Conveyor, portable; Curb machine; Deckhand; Digger (post hole, power-driven); Farm tractor, including farm tractor with all attachments (except backhoe, Hi- lift endloaders); Form grader; Form tamper, motor-driven; Generator; Guniting machine; Hetherington driver; Hydra seeder; Mechanical heater; Minor equipment operator, 1 through 4 pieces; Curing spraying machine; Power saw, concrete (power-driven); Pug mill pull broom, power type; Seaman tiller; Slurry seal machine; Spike machine; Straw blower or brush mulcher; Stripping machine (paint, motor-driven); Sub grader; Throttle valve; Tractaire with drill; Truck crane and multi-drill oiler, driver; Spreader; Water pump.

 ENGI0181-015 04/01/2022

SEWER WATERLINE & UTILITY CONSTRUCTION:

BARTHOLOMEW, BROWN, CLARK, CRAWFORD, DEARBORN, DECATUR, DUBOIS, FLOYD, FRANKLIN, GIBSON, HARRISON, JACKSON, JEFFERSON, JENNINGS, LAWRENCE, MARTIN, OHIO, ORANGE, PERRY, PIKE, POSEY, RIPLEY, SCOTT, SPENCER, SWITZERLAND, VANDERBURGH, WARRICK, and WASHINGTON COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP A.....	\$ 39.50	19.28
GROUP B.....	\$ 36.85	19.28

SEWER WATERLINE & UTILITY CONSTRUCTION

GROUP A: A-frame winch truck; Air compressor 900 cu. ft. and over; Air tugger; Autograde (CMI); Auto patrol; Backhoe; Ballast regulator (RR); Batch plant (electrical control concrete); Bending machine (pipe); Bituminous plant (engineer); Bituminous plant; Bituminous mixer travel plant; Bituminous paver; Bituminous roller; Buck hoist; Bulldozer; Cableway; Chicago boom; Clamshell; Concrete mixer, 21 cu. ft. or over; Concrete paver, concrete pump, crete; Crane; Craneman; Crusher plant; Derrick; Derrick boat; Dinky; Dope pots (pipeline); Dragline; Dredge operator; Dredge engineer; Drill operator; Elevator grader; Elevator; Ford hoe, or similar type equipment; Forklift; Formless paver; Gantry crane; Gradall; Grademan; Hopto; Hough loader or similar type; Hydro crane; Motor crane; Mucking machine; Multiple tamping machine (RR); Overhead crane; Pile driver; Pulls; Push dozer; Push boats; Roller (sheep foot); Ross Carrier; Scoop; Shovel; Side boom; Swing crane; Trench machine; Welder (heavy duty; Truck-mounted concrete pump; Truck-mounted drill; Well point; Whirleys.

GROUP B: Air compressor, up to 900 cu. ft.; Brakeman; Bull float; Concrete mixer, over 105 and under 215; Concrete spreader or puddler; Deck engine; Electric vibrator compactor (earth or rock); Finishing machine; Fireman; Greaser, on grease facilities servicing heavy equipment; Material pump; Motor boats; Portable loader; Post hole digger; Power broom; Rock roller; Roller, wobble wheel (earth and rock); Spike machine (RR); Seaman tiller; Spreader rock; Sub grader; Tamping machine; Welding machine; Widener, Apsco or similar type; Bituminous distributor; Cement gun; Concrete saw; Conveyor; Deckhand

oiler; Earth roller; Form grader; Generator; Guard rail driver; Heater; JLG lifts; Oiler; Paving joint machine; Power traffic signal; Scissor lift; Steam Jenny; Truck crane oiler; Vibrator; Water pump.

ENGI0841-011 04/01/2020

HEAVY, HIGHWAY AND UTILITY CONSTRUCTION

BOONE, CLAY, DAVIESS, FOUNTAIN, GREENE, HENDRICKS, KNOX, MONROE, MONTGOMERY, MORGAN OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLIAN, VIGO, and WARREN COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1.....	\$ 33.75	23.00+a
GROUP 2.....	\$ 27.50	23.00+a

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Air Compressor Over 600 CU FT, Air Compressors (2), Compressors hooked in Manifold, Asphalt Plant Engineer, Auto Grade and/or C.M.I. or similar type Machine, Auto Patrol, Motor Patrol, Power Blade, Aspco Paver, Asphalt Planer, Asphalt Rollers, Asphalt Paver Operator, Concrete or Asphalt Milling Machine, Self Propelled Widener, Backhoe and/or Pavement Breaker Attachment, Self Propelled Pavement Breaker, Ballast Regulator (R.R), Bituminous Mixer, Bituminous Paver, Bituminous Plant Engineer, Bulk Cement Plant Engineer, Bulldozer, One Drum Hoist with Tower or Boom, Cableways, Tower Machines, Back Filler, Boom Tractor, Boom or Winch Truck, Winch or Hydraulic Boom Truck, Boring Machine, Bolier Operator, Brush Mulcher, Bull Float, Finishing Machine, Power Cranes, Overhead Cranes, Truck cranes, Piledriver, Skid or Crawler, Guard Rail Post Driver, Tower Cranes, Hydro Crane, Cherry Picker, Draglines, Derricks, Shovels, Clam, Gradalls, Two Drum Machine, Concrete or Asphalt Curb Machine, Self Propelled, Concrete Mixers with Skid, Tournamixer, Concrete Pump (Truck or Skid Mounted), Concrete Plant Engineer, Soil Cement Machine, Formless Paver, Concrete Spreader, Span Saw (and similar types), Chip Spreader, Mesh Placer, Dredging Equipment or Dredge Engineer or Dredge Operator, Tug Boat Operator, Marine Scoops, Ditching Machine with Dual Attachment, Standard or Dinkey Locomotives, Drilling Machine, including Well Testing, Caissons, Shaft or any similar type Drilling Machine (Well Point Systems), 4 Point Life System (Power Lift or similar type), Mud Cat, Mucking Machine, Sull-Air, Mechanics, Welder, Head Equipment Greaser, Tournapull, Tractor Operating Scoops, Push Tractors, Large Rollers on Earth, Loaders (Track or Rubber Mounted), or similar type Machine, Lull, Tournadozer, Scoopmobiles, Elevating Machines, Power Broom (Self Propelled), Power Sub Grader, Hydra Ax, Farm Tractor with Attachments, Soil Stabilizer (Seaman Tiller, Bo mag, Rago Gator and similar types of equipment), Tree Mover, Stump Remover, Root Rake, Hydra Seeder, Straw Blower, Refrigerating Machine, Freezing Operator, Chair Cart-Self Propelled, Helicopter Crew (3), Ross Carrier or Straddle Buggy or similar Machine, Rock Crusher Plant, Gravel Processing Machine, Pipe Cleaning Machine, Pipe Wrapping Machine, Pipe Bending Machine, Pug Mill, Concrete Bump

Grinder Machine, Power Curing Spray Machine, Forklift (except when used for landscaping), Snooper Truck Operator.

GROUP 2: Air Compressor 600 cu. ft. and under, Air Tugger, Air Valves, Assistant Concrete Plant Engineer, Assistant Asphalt Plant Engineer, Asphalt Plant Fireman, Bulk Cement Plant Equipment Greaser, Concrete Mixers without Skips, Curbing Machine, Concrete Saw (Self Propelled), Conveyors, Cement Blimps, Ditching Machine under 6", Distributor Operator On trucks, Deck Hands, Elevators when used for hoisting material, Engine Tenders, Fork Lift (when used for landscaping), Farm Tractor, Fireman, Fireman on Paint or Dope Pots, Form Tamper, Form Grader, Flex Plane, Generators (two to four), or Welding Machines or Water Pumps, within 400 feet, Guniting Machine, Machine Mounted Post Hole Digger, Mude Jack, One Drum Machines without Tower or Boom, One Water Pump, One Welding Machine, Outboard or Inboard Motor Boat, Pull Broom (Power Type, Siphons and Pulsometer, Switchman, Striping and or Painting Machine (motor driven), Slurry Seal Machine, Track Jack, Temporary Heat, Throttle Valve, Tube Float, Tractaire, Wagon Drill, Multiple Tamping Machine (R.R.), Spike Machine (R.R.), Mechanical Heaters, Brush Burner, Vacuum Truck (Super Sucker and similar types).

FOOTNOTES:

A. Employees operating booms from 149Ft. to 199 Ft. including jib, shall receive an additional seventy-five Cents (.75) per hour above the rate. Employees operating booms over 199 Ft. including jib, shall receive an additional one dollar and twenty-five cents (\$1.25) per hour above the regular rate.

B. Employees operating scoops, pulls, or tractors hooked in tandem shall receive an additional one dollar (\$1.00) per hour above the regular rate.

C. Employees operating scoops, pulls, or tractors pulling any other hauling unit in tandem shall receive an additional one dollar (\$1.00) per hour above the regular rate.

D. Underground work - Employees working in tunnels, shafts, etc. shall be paid a thirty percent (30%) premium above the wage rate.

IRON0022-001 06/01/2022

BARTHOLOMEW, BENTON, BOONE, BROWN, CARROLL, CASS, CLAY, CLINTON, DAVIESS (REMAINDER OF COUNTY), DECATUR (W 3/4), DELAWARE (REMAINDER OF COUNTY), FAYETTE (W 1/3), FOUNTAIN, FRANKLIN (NW TIP), FULTON (REMAINDER OF COUNTY), GRANT (REMAINDER OF COUNTY), GREENE, HAMILTON, HANCOCK, HENDRICKS, HENRY, HOWARD, JACKSON, JASPER (SOUTHEASTERN 1/2), JENNINGS (NORTHWEST 2/3), JOHNSON, KNOX (REMAINDER OF COUNTY), LAWRENCE, MADISON, MARION, MARTIN (NW 2/3), MIAMI (REMAINDER OF COUNTY), MONROE, MONTGOMERY, MORGAN, NEWTON (SOUTHERN 1/2), OWEN, PARKE, PULASKI (REMAINDER OF COUNTY), PUTNAM, RANDOLPH (SW TIP), RUSH (REMAINDER OF COUNTY), SHELBY, SULLIVAN, TIPPECANOE, TIPTON, VERMILLION, VIGO, WAYNE, WARREN AND WHITE COUNTIES:

IRONWORKER.....\$ 34.24 25.11

The following holidays shall be observed: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and the day after Thanksgiving and Christmas Day. Any holiday which occurs on a Sunday shall be observed the following Monday, unless the legal observance of these holidays is changed by law.

IRON0044-010 06/01/2022

DEARBORN, DECATUR (REMAINDER OF COUNTY), FAYETTE (REMAINDER OF COUNTY), FRANKLIN (REMAINDER OF COUNTY), JEFFERSON (REMAINDER OF COUNTY), JENNINGS (REMAINDER OF COUNTY), OHIO, RIPLEY, RUSH (SOUTHEASTERN TIP), SWITZERLAND, AND UNION (SOUTHERN 1/3)

	Rates	Fringes
Ironworkers:		
FENCE ERECTORS.....	\$ 30.28	22.30
ORNAMENTAL.....	\$ 31.87	22.30
STRUCTURAL, MACHINERY MOVERS, RIGGERS.....	\$ 31.87	22.30

IRON0070-002 06/01/2022

CLARK, CRAWFORD, FLOYD, HARRISON, JACKSON (SOUTHERN 3/4); JEFFERSON (EXCLUDING NORTHEASTERN TIP); JENNINGS (SOUTHERN 3/4), LAWRENCE (SOUTHERN 2/3), MARTIN (SOUTHEASTERN 2/3), ORANGE, PERRY (EASTERN 3/4); SCOTT AND WASHINGTON COUNTIES:

	Rates	Fringes
IRONWORKER.....	\$ 31.79	24.62

IRON0070-016 06/01/2022

DEARBORN, DECATUR (REMAINDER OF COUNTY), FAYETTE (SE CORNER), FRANKLIN (S 3/4), OHIO, RIPLEY (REM. OF COUNTY), SWITZERLAND (REMAINDER OF COUNTY) and JENNINGS (NE TIP) COUNTIES

	Rates	Fringes
IRONWORKER (Reinforcing).....	\$ 31.79	24.62

IRON0103-001 04/01/2022

DAVIESS (S 1/2), DUBOIS, GIBSON, KNOX (S 1/2), MARTIN (SW 1/3), PERRY (W 1/4), PIKE, POSEY, SPENCER, VANDERBURGH, AND WARRICK

	Rates	Fringes
IRONWORKER.....	\$ 30.59	25.66

IRON0147-004 06/01/2022

ADAMS, ALLEN, BLACKFORD, DEKALB, DELAWARE (NORTHEAST THIRD OF COUNTY), FULTON (EASTERN PART), GRANT (EXCLUDING SOUTHWEST PORTION), HUNTINGTON, JAY, MIAMI (NORTHEAST HALF), NOBLE

(EXCLUDING NORTHEAST TIP), STEUBEN, WABASH, WELLS, and WHITLEY COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 31.20	25.12

IRON0290-004 06/01/2022		

FAYETTE (NE 1/4), RANDOLPH (S. PART OF COUNTY EXCLUDING WINCHESTER BUT INCLUDING UNION CITY) UNION (NORTHERN 2/3) AND WAYNE (REMAINDER OF COUNTY) COUNTIES

	Rates	Fringes
Ironworkers:.....	\$ 31.59	24.40

IRON0292-005 06/01/2022		

ELKHART, FULTON (North 2/3), KOSCIUSKO (Remainder of County), LAGRANGE (West 1/3), MARSHALL, MIAMI (Northwestern Tip), NOBLE (Northwestern Tip), PULASKI (Northeast Half), and STARKE COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 33.62	24.25

IRON0395-002 06/01/2022		

JASPER (NORTHERN 1/2), NEWTON (NORTHERN 1/2), PULASKI (NORTHWESTERN TIP) COUNTIES

	Rates	Fringes
IRONWORKER		
IRONWORKERS.....	\$ 43.00	37.24
SHEETER.....	\$ 41.75	34.54

LABO0041-003 04/01/2022		

HEAVY & HIGHWAY CONSTRUCTION

NEWTON COUNTY

	Rates	Fringes
LABORERS		
Group 1.....	\$ 31.74	23.63
Group 2.....	\$ 32.04	23.63
Group 3.....	\$ 32.74	23.63

LABORERS CLASSIFICATIONS (HEAVY AND HIGHWAY)

GROUP 1: Construction Laborer, Carpenter Tender, Fence Erector, Grade Checker, Guard Rail Erector, Continuous Steel Rod or Mat Installer, Wire Mesh Layer, Joint Man (Mortar, Mastic, and all other types), Lighting Installer (Permanent or Temporary), Lineman for Automatic Grade Maker on Paving Machines, Mortar Man, Multi-Plant Erector, Rip-rap Installer (all Products and Materials), Road

Marking and Delineation Laborer, Setting and Placing of all Precast Concrete Products, Sing Installation including supporting structure, Spraying of all Epoxy, Curing Compound, or Like Material, Flagperson, Air Tool, Power Tool Operator, Asphalt Raker Man, Batch Truck Dumper, Bridge Hand Rail Erector, Handler (bulk or bag cement), Chain Saw Man, Concrete Puddler, Concrete Rubber, Concrete Saw Operator, Core Drill Operator, Eye Level, Hand Blade Operator Hydro Seeder Man, Motor Driven Georgia Buggy Operator, Power Driven Compactor or Taper Operator, Power Saw Operator, Pump Crete Assembly Man, Sreed Man or Screw Man on Asphalt Paver, Regar Installer, Sandblaster Man, Sealer Applicator for Asphalt (toxic), Setting and Placing pre-stressed on Pre-cast Concrete Structural Members, Side Rail Setters (for Sidewalk, Side Ditches, Radii, and Pavement), Spreader Box Tender (manua or power driven), Straw Blower Man, Subsurface Drain and Culvert Pipe Layer, Concrete Conveyor, Horizontal Boring and Jackman and Sheetman, Pipe Greade Man, Winch and Windless Operator Conduit Installer, Sod Layer

GROUP 2: Cutting Torch Burner, Laser Beam Aligner, Manhole Erector, Sewer Pipe Layer, Water Line Installer, Temporary or Permanent Welders (electric or Oxy Acetylene)

GROUP 3: Air Track and Wagon Drillman, Dynamite and Powder Man, Concrete Barrier Rail Form Setter, Concrete Saw Joint Control Cutting

 LAB00041-005 04/01/2022

UTILITY CONSTRUCTION

JASPER & NEWTON COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 31.74	23.63
GROUP 2.....	\$ 32.04	23.63
GROUP 3.....	\$ 32.74	23.63

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing

prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, Hod Carrier (tending bricklayers); TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Concrete Saw Joint Control cutting

LAB00041-006 04/01/2022

HEAVY & HIGHWAY CONSTRUCTION

JASPER & STARKE COUNTIES

	Rates	Fringes
LABORERS		
Group 1.....	\$ 28.97	23.63
Group 2.....	\$ 29.27	23.63
Group 3.....	\$ 29.97	23.63

LABORERS CLASSIFICATIONS (HEAVY AND HIGHWAY)

GROUP 1: Construction Laborer, Carpenter Tender, Fence Erector, Grade Checker, Guard Rail Erector, Continuous Steel Rod or Mat Installer, Wire Mesh Layer, Joint Man (Mortar, Mastic, and all other types), Lighting Installer (Permanent or Temporary), Lineman for Automatic Grade Maker on Paving Machines, Mortar Man, Multi-Plant Erector, Rip-rap Installer (all Products and Materials), Road Marking and Delineation Laborer, Setting and Placing of all Precast Concrete Products, Sing Installation including supporting structure, Spraying of all Epoxy, Curing Compound, or Like Material, Flagperson, Air Tool, Power Tool Operator, Asphalt Raker Man, Batch Truck Dumper, Bridge Hand Rail ERector, Handler (bulk or bag cement), Chain Saw Man, Concrete Puddler, Concrete Rubber, Concrete Saw Operator, Core Drill Operator, Eye Level, Hand Blade Operator Hydro Seeder Man, Motor Driven Georgia Buggy Operator, Power Driven Compactor or Taper Operator, Power Saw Operator, Pump Crete Assembly Man, Sreed Man or Screw Man on Asphalt Paver, Regar Installer, Sandblaster Man, Sealer Applicator for Asphalt (toxic), Setting and Placing pre-stressed on Pre-cast Concrete Structural Members, Side Rail Setters (for Sidewalk, Side Ditches, Radii, and Pavement), Spreader Box Tender (manua or power driven), Straw Blower Man, Subsurface Drain and Culvert Pipe Layer, Concrete Conveyor, Horizontal Boring and Jackman and Sheetman, Pipe Greade Man, Winch and Windless Operator Conduit Installer, Sod Layer

GROUP 2: Cutting Torch Burner, Laser Beam Aligner, Manhole

Erector, Sewer Pipe Layer, Water Line Installer, Temporary or Permanent Welders (electric or Oxy Acetylene)

GROUP 3: Air Track and Wagon Drillman, Dynamite and Powder Man, Concrete Barrier Rail Form Setter, Concrete Saw Joint Control Cutting

LAB00081-003 04/01/2022

UTILITY CONSTRUCTION

STARKE COUNTY

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 28.97	23.63
GROUP 2.....	\$ 29.27	23.63
GROUP 3.....	\$ 29.97	23.63

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural memebbers; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, Hod Carrier (tending bricklayers); TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Concrete Saw Joint Control cutting

LAB00120-003 04/01/2022

UTILITY CONSTRUCTION

MARION & SHELBY COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Concrete Saw Joint Control cutting; Hod Carrier (tending bricklayers)

LAB00204-003 04/01/2022

UTILITY CONSTRUCTION

CLAY, FOUNTAIN, GREENE, HENDRICKS, OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION, VIGO, & WARREN COUNTIES

Rates	Fringes
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Laborers:

GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Hod Carrier (tending bricklayers); Concrete Saw Joint Control cutting

LAB00213-003 04/01/2022

UTILITY CONSTRUCTION

ADAMS, ALLEN, DEKALB, HUNTINGTON, NOBLE, STEUBEN, WABASH, WELLS, & WHITLEY COUNTIES

Rates Fringes

Laborers:

GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Hod Carrier (tending bricklayers); Concrete Saw Joint Control cutting

LAB00274-005 04/01/2022

UTILITY CONSTRUCTION

BENTON, BOONE, CARROLL, CASS, CLINTON, FULTON, HOWARD, MIAMI, MONTGOMERY, PULASKI, TIPPECANOE, TIPTON, and WHITE COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all

precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, Tving and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Hod Carrier (tending bricklayers); Concrete Saw Joint Control cutting

LAB00561-015 04/01/2022

UTILITY CONSTRUCTION

DAVISS, DUBOIS, GIBSON, KNOX, PIKE, POSEY, SPENCER, VANDERBURGH, & WARRICK COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator;

Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, Hod Carrier (tending bricklayers); TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Concrete Saw Joint Control cutting

LAB00645-005 04/01/2022

UTILITY CONSTRUCTION

ELKHART COUNTY

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven);

Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, Hod Carrier (tending bricklayers); TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Concrete Saw Joint Control cutting

LAB00645-006 04/01/2022

UTILITY CONSTRUCTION

KOSCIUSKO, LAGRANGE, & MARSHALL COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in

connection with waterline and sewer work, Hod Carrier (tending bricklayers); TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Concrete Saw Joint Control cutting

LAB00741-007 04/01/2022

UTILITY CONSTRUCTION

BARTHOLOMEW, BROWN, DEARBORN, DECATUR, FRANKLIN, JACKSON, JENNINGS, JOHNSON, LAWRENCE, MARTIN, MONROE, MORGAN, OHIO, ORANGE & RIPLEY COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Hod Carrier (tending bricklayers); Concrete Saw Joint Control

cutting

LAB00795-004 04/01/2022

UTILITY CONSTRUCTION

CLARK, CRAWFORD, FLOYD, HARRISON, JEFFERSON, PERRY, SCOTT,
SWITZERLAND, & WASHINGTON COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man (mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural memebbers; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or exy-acetylene) in connection with waterline and sewer work, Hod Carrier (tending bricklayers); TVing and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; General leadman; Concrete Saw Joint Control cutting

LAB00999-001 04/01/2020

HEAVY AND HIGHWAY CONSTRUCTION

ALL COUNTIES EXCEPT: Jasper, Newton, & Starke

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 25.10	16.17
GROUP 2.....	\$ 25.40	16.17
GROUP 3.....	\$ 26.10	16.17

LABORERS CLASSIFICATIONS

GROUP 1: Building and Construction Laborers; Scaffold Builders (other than for Plasterers); Mechanic Tenders; Window Washers and cleaners; Waterboys and Toolhousemen; Roofers Tenders; Railroad Workers; Masonry Wall Washers (interior and exterior); Cement Finisher Tenders; Carpenter Tenders; All Portable Water pumps with discharge up to (3) inches; Plaster Tenders; Mason Tenders; Flag & Signal Person.

GROUP 2: Waterproofing; Handling of Creosot Lumber or like treated material (excluding railroad material); Asphalt Rakers and Lutemen; Kettlemen; Air Tool Operators and all Pneumatic Tool Operators; Air and Electric Vibrators and Chipping Hammer Operators; Earth Compactors Jackmen and Sheetmen working Ditches deeper than (6) ft.in depth; Laborers working in ditches (6) ft.in depth or deeper; Assembly of Unicrete Pump; Tile Layers (sewer or field) and Sewer Pipe Layer (metallic or non-metallic); Motor driven Wheelbarrows and Concrete Buggies; Hyster Operators; Pump Crete Assemblers; Core Drill Operators; Cement, Lime or Silica Clay Handlers (bulk or bag); Handling of Toxic Materials damaging to clothing; Pneumatic Spikers; Deck Engine and Winch Operators; Water Main and Cable Ducking (metallic and non-metallic); Screed Man or Screw Operator on Asphalt Paver; Chain and Demolition Saw Operators; Concrete Conveyor Assemblers.

GROUP 3: Water Blast Machine Operator; Mortar Mixers; Welders (Acetylene or electric); Cutting Torch or Burner; Cement Nozzle. Laborers; Cement Gun Operator; Scaffold Builders when Working for Plasterers. Dynamite Men; Drillers - Air Track or Wagon Drilling for explosives Hazardous and Toxic material handler, asbestos removal or handler.

LAB01112-003 04/01/2022

UTILITY CONSTRUCTION

BLACKFORD, DELAWARE, FAYETTE, GRANT, HAMILTON, HANCOCK, HENRY, JAY, MADISON, RANDOLPH, RUSH, UNION & WAYNE COUNTIES

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 27.40	17.22
GROUP 2.....	\$ 27.90	17.22
GROUP 3.....	\$ 28.40	17.22

LABORERS CLASSIFICATIONS (UTILITY CONSTRUCTION)

GROUP 1: Construction laborer; Fence erector; Flagger; Grade checker; Guard rail erector; Wire mesh layer; Joint man

(mortar, mastic and all other types); Lighting installer (permanent or temporary); Lineman for automatic grade maker on paving machines; Mortar man; Multi-plate erector; Rip-rap installer (all products and materials); Road marking and delineation laborer; Setting and placing of all precast concrete products; Sign installation including supporting structure; Spraying of all epoxy, curing compound, or like material; sod layer; Air tool, power tool, and power equipment operator; Asphalt lute man; Asphalt raker man; Batch truck dumper; Bridge handrail erector; Handler (bulk or bag cement); Chain saw man; concrete puddler; concrete rubber; Concrete saw operator; Core drill operator, eye level; Hand blade operator; Hydro seeder man; Motor-driven Georgia buggy operator; Power-driven compactor or tamper operator; Power saw operator; Pumpcrete assembly man; Screed man or screw man on asphalt paver; Rebar installer; Sandblaster man; Sealer applicator for asphalt (toxic); Setting and placing prestressed or precast concrete structural members; Side rail setter (for sidewalks, side ditches, radii, and pavements); Spreader box tender (manual or power-driven); Straw blower man; Subsurface drain and culvert pipe layer; Transverse and longitudinal hand bull float man; Concrete conveyor assembly man; Horizontal boring and jacking man; Jackman and sheetman; Pipe grade man; Winch and windlass operator

GROUP 2: Cutting torch burner; Laser beam aligner; Manhole erector; Sewer pipe layer; Water line installer, temporary or permanent; Welder (electric or oxy-acetylene) in connection with waterline and sewer work, Tving and associated grouting of utility lines

GROUP 3: Air track and wagon drillman; Concrete barrier rail form setter; Dynamite and powder man; Hod Carrier (tending bricklayers); General leadman; Concrete Saw Joint Control cutting

 PAIN0012-006 05/01/2020

COMMERCIAL AND INDUSTRIAL

DEARBORN, OHIO, RIPLEY AND SWITZERLAND COUNTIES:

	Rates	Fringes
PAINTER		
Bridges, Lead Abatement.....	\$ 26.30	11.35
Brush & Roller,		
Paperhanger, Drywall Taping.	\$ 25.30	11.35
Sandblasting, Waterblasting.	\$ 26.05	11.35
Spray.....	\$ 25.80	11.35

 PAIN0027-005 06/01/2022

NEWTON COUNTY, West of Highway #41

	Rates	Fringes
GLAZIER.....	\$ 48.75	41.32

 PAIN0047-005 06/01/2022

BARTHOLOMEW, BOONE, BROWN, DECATUR, HAMILTON, HANCOCK,

HENDRICKS, JACKSON, JENNINGS, JOHNSON, LAWRENCE, MARION,
MARTIN, MONROE, MORGAN, ORANGE, AND SHELBY COUNTIES

	Rates	Fringes
PAINTER		
BRIDGE WORK		
Concrete/Masonry Bridges...	\$ 26.44	13.30
Steel Bridges.....	\$ 30.50	14.50
NON-BRIDGE WORK		
Brush, Roller.....	\$ 28.10	15.81
Spray and Sand-Blasting....	\$ 29.10	15.81

PAIN0080-001 06/01/2022		

BENTON, CARROLL, CASS, CLINTON, FOUNTAIN, MONTGOMERY TIPPECANOE
AND WARREN COUNTIES

	Rates	Fringes
PAINTER		
Brush and Roller.....	\$ 27.13	17.43
Spray and Sandblasting.....	\$ 27.18	17.43

PAIN0091-007 06/01/2022		

ELKHART, FULTON, KOSCIUSKO AND MARSHALL COUNTIES

	Rates	Fringes
PAINTER		
Brush & Roller, Drywall		
Taping & Finishing,		
Vinyl/Paper Hanging.....	\$ 28.75	17.00
Spray.....	\$ 29.25	17.00

PAIN0118-005 06/01/2022		

CLARK, CRAWFORD, FLOYD, HARRISON JEFFERSON, SCOTT AND
WASHINGTON COUNTIES

	Rates	Fringes
Painters:		
Heavy Construction		
Brush, Roller &		
Paperhanger.....	\$ 22.20	14.07
Spray, Sandblast &		
Waterblast.....	\$ 23.45	13.19
Highway Construction &		
Railroad Bridges		
Brush, Roller &		
Paperhanger.....	\$ 29.81	14.58
Spray, Sandblast &		
Waterblast.....	\$ 30.81	14.58

PAIN0156-001 04/01/2020		

DAVISS, DUBOIS, GIBZSON, KNOX, PERRY, PIKE, POSSEY, SPENCER,
VANDERBURGH, AND WARRICK COUNTIES

Rates Fringes

Painters:

BRUSH & ROLLER OF MASTICS, CREOSOTES, KEWINCH KOATE, & COAL TAR EPOXY.....	\$ 28.60	17.53
BRUSH & ROLLER.....	\$ 27.60	17.53
DRYWALL FINISHERS.....	\$ 27.85	17.53
SPRAY of MASTICS CREOSOTES, KWINCH KOATE, COAL TAR EPOXY.....	\$ 29.60	17.53
SPRAY, SANDBLAST, POWER TOOLS, WATERBLAST & STEAM CLEANING.....	\$ 28.60	17.53

FOOTNOTE A:

All Structures over 40? \$0.75/ hour above base wage
 All Structures over 75? \$1.50/ hour above base wage
 All Structures over 100? \$2.50/ hour above base wage

 PAIN0197-001 06/01/2022

CLAY, GREENE, OWEN, PARKE, PUTNAM, SULLIVAN, VERMILLION AND
 VIGO COUNTIES:

Rates Fringes

Painters:

Brush & Roller.....	\$ 28.50	13.70
Sandblasting.....	\$ 30.50	13.70
Spray & Pot Man.....	\$ 29.00	13.70

FOOTNOTE A: \$1.00 premium for work on structures over 40 ft.
 above floor/ground level
 \$2.00 premium for work on structures over 100 ft
 above floor/ground level

 PAIN0387-004 11/01/2022

DEARBORN, FRANKLIN, OHIO, RIPLEY, and SWITZERLAND COUNTIES

Rates Fringes

GLAZIER.....	\$ 28.18	16.82
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 PAIN0460-004 06/01/2022

JASPER, NEWTON, PULASKI, STARKE AND WHITE COUNTIES

Rates Fringes

Painters:

Brush & Roller Building.....	\$ 37.10	27.68
Brush and Roller Heavy and Highway.....	\$ 37.10	27.68
Drywall Taping & Finishing..	\$ 37.98	27.68

 PAIN0469-002 06/01/2022

ADAMS, ALLEN, DEKALB, GRANT, HUNTINGTON, LAGRANGE, NOBLE,
 STEUBEN, WABASH, WELLS, and WHITLEY COUNTIES

	Rates	Fringes
Painters:		
Brush, Roller, Paperhanger, & Drywall Finishing.....	\$ 23.77	14.74
Lead Abatement.....	\$ 27.66	14.30
Spray & Sandblast Pot Tenders and Ground Personnel.....	\$ 24.86	14.30
Spray, Sandblast, Power Tools, Waterblast, & Steam Cleaning.....	\$ 24.86	14.30

PAIN0669-001 05/01/2022

BLACKFORD, DELAWARE, FAYETTE, FRANKLIN, HENRY, HOWARD, JAY,
MADISON, MIAMI, RANDOLPH, RUSH, TIPTON, UNION and WAYNE COUNTIES

	Rates	Fringes
Painters:		
Brush; Roller; Paperhanging; Drywall Finishers.....	\$ 22.70	15.29
Spray/Waterblasting; Sandblasting.....	\$ 23.70	15.29

PAIN1165-014 07/01/2022

CLARK, CRAWFORD, DAVIESS, DUBOIS, FLOYD, GIBSON, HARRISION,
JEFFERSON, KNOX, MARTIN, ORANGE, PERRY, PIKE, POSEY, SCOTT,
SPENCER, VANDERBURGH, WARRICK AND WASHINGTON

	Rates	Fringes
GLAZIER.....	\$ 30.87	18.43

PAIN1165-017 07/01/2022

ADAMS, ALLEN, BLACKFORD, DE KALB, GRANT, HUNTINGTON, JAY,
NOBLE, STEUBEN, WABASH, WELLS AND WHITLEY COUNTIES

	Rates	Fringes
GLAZIER.....	\$ 27.42	17.15

PAIN1165-018 07/01/2022

JASPER and NEWTON (East of Highway #41) COUNTIES

	Rates	Fringes
GLAZIER.....	\$ 39.38	26.90

PAIN1165-019 07/01/2021

ELKHART, FULTON, KOSCIUSKO, LAGRANGE, MARSHALL, PULASKI, and
STARKE COUNTY

	Rates	Fringes
GLAZIER.....	\$ 29.81	17.68

PAIN1165-022 01/01/2022		

BARTHOLOMEW, BENTON, BOONE, BROWN, CARROLL, CASS, CLAY, CLINTON, DECATUR, DELEWARE, FAYETTE, FOUNTAIN, GREENE, HAMILTON, HANCOCK, HENDRICKS, HENRY, HOWARD, JACKSON, JENNINGS, JOHNSON, LAWRENCE, MADISON, MARION, MIAMI, MONROE, MONTGOMERY, MORGAN, OWEN, PARKE, PUTNAM, RANDOLPH, RUSH, SHELBY, SULLIVAN, TIPPECANOE, TIPTON, UNION, VIGO, VERMILLION, WARREN, WAYNE, and WHITE COUNTIES

	Rates	Fringes
GLAZIER.....	\$ 30.88	18.70

PLAS0075-001 06/01/2017		

CLAY, OWEN, PARKE, PUTNAM, VERMILLION AND VIGO COUNTIES:

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.75	13.50

PLAS0075-002 06/01/2017		

GREENE and SULLIVAN COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 28.50	13.50

PLAS0101-001 06/01/2018		

ELKHART, FULTON AND MARSHALL COUNTIES; PULASKI COUNTY (SOUTHERN 1/2):

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 31.50	14.30

PLAS0101-008 06/01/2014		

ADAMS, ALLEN, DEKALB, HUNTINGTON, KOSCIUSKO, LAGRANGE, NOBLE, STEUBEN, WELLS AND WHITLEY COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 23.38	11.94
PLASTERER.....	\$ 25.69	11.75

PLAS0438-003 06/01/2018		

PULASKI (NORTHERN 2/3), JASPER (N. EASTERN PORTION OF WEST TO BUT NOT INCLUDING WHEATFIELD), ALL OF STARKE COUNTY

Rates	Fringes
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CEMENT MASON/CONCRETE FINISHER...\$ 36.01 25.40

PLAS0692-002 06/01/2016

AREA #46

BARTHOLOMEW, BOONE, BROWN, CLARK, CLAY, CRAWFORD, DAVIESS,
DUBOIS, GIBSON, HENDRICKS, JACKSON, JEFFERSON, JENNINGS,
JOHNSON, KNOX, LAWRENCE, MARION, MARTIN, MONROE, MORGAN,
ORANGE, OWEN, PARKE, PERRY, PIKE, POSEY, PUTNAM, SCOTT, SHELBY,
SPENCER, VANDERBURGH, VERMILLION, VIGO and WARRICK COUNTIES

Rates Fringes
PLASTERER.....\$ 25.04 13.23

PLAS0692-008 05/01/2017

BARTHOLOMEW, BROWN, CLARK, DEARBORN, FLOYD, JACKSON, JEFFERSON,
JENNINGS, LAWRENCE, OHIO, ORANGE, RIPLEY, SCOTT, SHELBY,
SWITZERLAND, and WASHINGTON Counties

Rates Fringes
CEMENT MASON/CONCRETE FINISHER
AREA #821.....\$ 24.18 13.49

PLAS0692-009 04/01/2020

AREA #83

BLACKFORD, DELAWARE, GRANT, HAMILTON (Northern Part), HANCOCK
(Northern Part), JAY, MADISON, TIPTON, and WABASH COUNTIES

Rates Fringes
CEMENT MASON/CONCRETE FINISHER...\$ 26.00 15.54
PLASTERER.....\$ 25.49 11.95

PLAS0692-011 04/01/2020

AREA #83

DECATUR, FAYETTE, FRANKLIN, HENRY, RANDOLPH, RUSH, UNION and
WAYNE COUNTIES

Rates Fringes
CEMENT MASON/CONCRETE FINISHER...\$ 26.00 15.54
PLASTERER.....\$ 25.49 11.95

PLAS0692-015 06/01/2016

AREA #121

BENTON, CARROLL, CASS, CLINTON, FOUNTAIN, HOWARD, MIAMI,
MONTGOMERY, TIPPECANOE, WARREN, WHITE and VERMILLION (Northern
Part) COUNTIES

Rates Fringes

CEMENT MASON/CONCRETE FINISHER...	\$ 26.10	17.30
PLASTERER.....	\$ 27.71	16.40

 PLAS0692-018 06/01/2017

AREA #165

NEWTON COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 38.88	23.73

 PLAS0692-022 06/01/2017

Southward on Rt. No. 49 to the JASPER, BENTON and WHITE County lines, including the City Limits of Wheatfield, Rensselaer and Remington, Indiana. To the West, the boundary of NEWTON County

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER AREA #406.....	\$ 33.35	19.09

 PLAS0692-023 06/01/2018

AREA #532

BOONE, HAMILTON (SOUTH HALF OF COUNTY NORTH TO NEW ROUTE INDIANA #32 INCLUDING NOBLESVILLE); HANCOCK COUNTY (SOUTHERN AND WESTERN PART OF HANCOCK COUNTY, NORTH TO BUT NOT INCLUDING FORTVILLE); HENDRICKS, JOHNSON, MARION and MORGAN COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 26.45	18.11
Slip Form Shift Work.....	\$ 27.45	18.11
Swinging/Suspended Scaffold.	\$ 26.70	18.11

 PLAS0692-027 04/01/2020

AREA #566

CRAWFORD, DAVIESS, DUBOIS, GIBSON, HARRISON, KNOX, MARTIN, PERRY, PIKE, POSEY, SPENCER, VANDERBURGH and WARRICK COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 28.30	18.31

 PLUM0136-003 04/01/2022

BROWN, DAVIESS, DUBOIS, GIBSON, JACKSON, LAWRENCE, MARTIN, MONROE, ORANGE, OWEN, PERRY, PIKE, POSEY, SPENCER, VANDERBURGH, WARRICK, and WASHINGTON Counties

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 40.07	19.11

PLUM0157-002 07/01/2022

BENTON, CARROLL, CLINTON, FOUNTAIN, MONTGOMERY, TIPPECANOE,
WARREN AND WHITE COUNTIES:

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 40.15	20.85

PLUM0166-001 06/01/2022

ADAMS, ALLEN, BLACKFORD, DE KALB, GRANT, HUNTINGTON, NOBLE,
STEUBEN, WABASH, WELLS, and WHITLEY COUNTIES

	Rates	Fringes
Plumber and Steamfitter.....	\$ 39.26	17.81

PLUM0166-002 06/01/2022

ELKHART, KOSCIUSKO, and LAGRANGE COUNTIES

	Rates	Fringes
PLUMBER.....	\$ 39.26	17.81

PLUM0172-001 06/01/2022

JASPER (S of the N. Side of the City of Rensselear), MARSHALL,
PULASKI and STARKE COUNTIES

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	\$ 38.54	21.79

PLUM0210-003 09/01/2020

JASPER (to the City of Rensselaer) and NEWTON COUNTIES

	Rates	Fringes
PLUMBER.....	\$ 42.07	25.16

PLUM0392-006 06/01/2022

DEARBORN, OHIO, RIPLEY, AND SWITZERLAND COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 36.81	27.35

PLUM0440-002 06/04/2022

BARTHOLOMEW, BOONE, HAMILTON, HANCOCK, HENDRICKS, HOWARD,
JOHNSON AND MARION COUNTIES; MIAMI COUNTY (SOUTH OF A STRAIGHT
LINE WHERE ROUTE 218 ENTERS W. BOUNDARY); MORGAN, SHELBY and
TIPTON COUNTIES

Rates Fringes

Plumbers and Pipefitters.....\$ 41.57 18.99

PLUM0440-004 06/01/2018

FAYETTE, FRANKLIN, HENRY, RANDOLPH, RUSH, UNION and WAYNE
COUNTIES

Rates Fringes

Plumber and Steamfitter.....\$ 37.67 16.79

PLUM0502-001 08/01/2016

CLARK, FLOYD AND HARRISON COUNTIES

Rates Fringes

PLUMBER/PIPEFITTER.....\$ 32.00 20.13

PLUM0597-004 06/01/2018

JASPER (Excluding the city limits of Rensselear), AND NEWTON
(Entire County)

Rates Fringes

PIPEFITTER.....\$ 48.50 31.12

ROOF0023-004 06/01/2021

ADAMS, ALLEN, DEKALB, ELKHART, FULTON, HUNTINGTON, KOSCIUSKO,
LAGRANGE, MARSHALL, MIAMI, NOBLE, PULASKI, STARKE, STEUBEN,
WABASH, WELLS, and WHITLEY COUNTIES

Rates Fringes

ROOFER
COMPOSITION.....\$ 30.50 19.03
SLATE & TILE.....\$ 32.00 19.03

ROOF0026-002 06/01/2022

JASPER AND NEWTON COUNTIES

Rates Fringes

ROOFER.....\$ 40.79 24.47

ROOF0042-002 08/01/2022

DEARBORN, OHIO and RIPLEY COUNTIES

Rates Fringes

ROOFER.....\$ 30.90 17.05

ROOF0075-001 05/01/2022

FAYETTE, RANDOLPH, UNION, and WAYNE Counties

Rates Fringes

ROOFER

Composition.....	\$ 25.63	20.61
Slate & Tile.....	\$ 25.85	20.61

ROOF0075-002 05/01/2021

CLINTON COUNTY

Rates Fringes

ROOFER

Composition.....	\$ 24.38	20.09
Slate & Tile.....	\$ 24.60	20.09

ROOF0106-006 04/01/2021

CRAWFORD, DAVIESS, DUBOIS, GIBSON KNOX, MARTIN, ORANGE PERRY,
PIKE, POSEY, SPENCER, VANDERBURGH AND WARRICK

Rates Fringes

ROOFER

COMPOSITION.....	\$ 31.00	18.43
SLATE & TILE.....	\$ 30.80	16.52

ROOF0119-002 09/01/2021

BARTHOLOMEW, BLACKFORD, BOONE, BROWN, DECATUR, DELAWARE,
FRANKLIN, GRANT, HAMILTON, HANCOCK, HENDRICKS, HENRY, HOWARD,
JACKSON, JAY, JENNINGS, JOHNSON, LAWRENCE, MADISON, MARION,
MONROE, MONTGOMERY, MORGAN, PUTNAM, RUSH, SHELBY, and TIPTON
Counties

Rates Fringes

ROOFER.....	\$ 27.80	11.75
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ROOF0147-002 04/01/2018

CLARK, FLOYD, HARRISON JEFFERSON, SCOTT, SWITZERLAND, and
WASHINGTON Counties

Rates Fringes

ROOFER.....	\$ 24.43	10.20
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ROOF0150-002 07/01/2022

CLAY, GREENE, OWEN, PARKE, SULLIVAN, VERMILLION AND VIGO
COUNTIES

Rates Fringes

ROOFER.....	\$ 28.75	17.55
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SHEE0020-003 07/01/2022

Rates Fringes

Sheet metal worker (HVAC Duct Work).....	\$ 33.58	26.25
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SHEE0020-010 07/01/2022

BARTHOLOMEW, BOONE, BROWN, DECATUR, DELAWARE, FAYETTE,
FRANKLIN, HAMILTON, HANCOCK, HENDRICKS, HENRY, JACKSON,
JENNINGS, JOHNSON, LAWRENCE, MADISON, MARION, MONROE,
MONTGOMERY, MORGAN, ORANGE, RIPLEY, RUSH, SHELBY, TIPTON, UNION
AND WASHINGTON COUNTIES

	Rates	Fringes
SHEET METAL WORKER.....	\$ 38.83	25.27

SHEE0020-011 07/01/2022

CLINTON COUNTY

	Rates	Fringes
SHEET METAL WORKER.....	\$ 36.71	27.78

SHEE0020-024 07/01/2022

CLAY, GREENE, MARTIN, OWEN, PARKE, PUTNAM, SULLIVAN,
VERMILLION, and VIGO COUNTIES

	Rates	Fringes
Sheet metal worker.....	\$ 38.08	22.79

TEAM0135-003 04/01/2021

REMAINING COUNTIES

	Rates	Fringes
TRUCK DRIVER		
GROUP 1.....	\$ 31.16	17.27
GROUP 2.....	\$ 31.21	17.27
GROUP 3.....	\$ 31.26	17.27
GROUP 4.....	\$ 31.31	17.27
GROUP 5.....	\$ 31.36	17.27
GROUP 6.....	\$ 31.26	17.27
GROUP 7.....	\$ 31.46	17.27
GROUP 8.....	\$ 31.46	17.27
GROUP 9.....	\$ 31.56	17.27
GROUP10.....	\$ 31.01	17.27
GROUP11.....	\$ 31.56	17.27
GROUP12.....	\$ 31.66	17.27

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Single/batches axle straight trucks; Batch trucks,
wet or dry 3 (34E) axle or less; Single axle Grease and
maintenance truck

GROUP 2: Single axle fuel and water trucks

GROUP 3: Single axle ""dog-legs"", and tandem truck or dog-
legs; Winch trucks or A-frames when used for transportation
purposes; Drivers on batch trucks, wet or dry over 3 (34E)
batches and tandem axle grease and maintenance truck

GROUP 4: Tandem axle fuel trucks; tandem axle water trucks; butuminous distributors (two-man)

GROUP 5: Tandem trucks over 15 tons payload; Single axle semi trucks; Farm tractors hauling material; Mixer trucks (all types); Trucks pulling tilt-top trailer single axle; Single axle low- boys; Truck-mounted pavement breakers

GROUP 6: Tandem trucks or ""dog-legs""; Semi-water Truck; Sprinkler Truck; Heavy equipment-type water wagons, 5,000 gallons and under; butuminous distributors (one-man)

GROUP 7: Tri-axle trucks; Tandem axle semi trucks; Equipment when not self-loaded or pusher loaded, such as Koehring or similar dumpsters, track trucks, Euclid bottom dump and hug bottom dump, tournatrailers, tournarockers, Acey wagons or for similar equipment (12 cu yds or less); Mobile mixer truck; Tandem Axle trucks pulling tilt-top trailer; Tandem - Axle lowboy; Tri- Axle batch Truck; Tri-Axle grease and maintenance truck

GROUP 8: Tandem-tandem semi trucks; Truck mechanics and welders; Heavy equipment-type water wagon over 5,000 gallons; Tri-Axle Trucks pulling tilt-top trailer; Low-boys, tandem-tandem axle

GROUP 9: Low-boys, tandem tri-axle; Acey wagons up to and including 3 buckets; Equipment when not self-loaded or pusher loaded, such as koehring or similar dumpsters, Track Trucks, Euclid bottom dump and hug bottom dump, Tournatrailers, Tournarockers, Acey wagons or for similar equipment (over 12 cu yds.)

GROUP 10: Pick-up trucks

GROUP 11: Helpers; Greasers; Tire men; Batch board tenders; Warehouseman

GROUP 12: Acey wagon (over 3 buckets); Quad Axle Trucks; Articulating Dump

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>.

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) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which 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. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of 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. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the

classifications was union data. EXAMPLE: UAVG-OH-0010
08/29/2014. UAVG indicates that the rate is a weighted union
average rate. OH indicates the state. The next number, 0010 in
the example, is an internal number used in producing the wage
determination. 08/29/2014 indicates the survey completion date
for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of
each year, to reflect a weighted average of the current
negotiated/CBA rate of the union locals from which the rate is
based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can
be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on
a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests
for summaries of surveys, should be with the Wage and Hour
National Office because National Office has responsibility for
the Davis-Bacon survey program. If the response from this
initial contact is not satisfactory, then the process described
in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal
process described here, initial contact should be with the
Branch of Construction Wage Determinations. Write 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 the answer to the question in 1.) is yes, then an
interested party (those affected by the action) can request
review and reconsideration from the Wage and Hour Administrator
(See 29 CFR Part 1.8 and 29 CFR Part 7). Write 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 by 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

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

EXHIBIT C

DAVIS-BACON ACT PROVISIONS AND FORMS

ATTACHMENT B

REQUIRED CONTRACT PROVISIONS RELATED TO DAVIS-BACON ACT AND RELATED ACTS

(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 (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 Section (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 (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.

(ii)(A) The Town of Wheatland 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 EPA award official shall approve 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 Town of Wheatland agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the Town of Wheatland 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. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action 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 Town of Wheatland 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 questions, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt 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 (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 Town of Wheatland 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 Town of Wheatland, 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 Town of Wheatland 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 Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> 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 Town of Wheatland 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 Town of Wheatland.

(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; and

(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 (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 (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 the Town of Wheatland.

(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 is 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 governing federal 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.

(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.

(11) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen and guards shall require or permit any such laborer, mechanic, watchman or guard 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, mechanic, watchman or guard 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.

(12) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in the above paragraph (11) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman or guard employed in violation of the clause set forth in the above paragraph (11) 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 the above paragraph (11) of this section.

(13) Withholding for unpaid wages and liquidated damages. The Town of Wheatland 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 the above paragraph (12) of this section.

(14) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (11) through (14) 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

(11) through (14) of this section.

(b) In addition to the clauses contained in paragraph (13), 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 Town of Wheatland 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, mechanics, watchmen and guards 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 Town of Wheatland 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.

[29 CFR 5.5]

ATTACHMENT C

**REQUIRED WAGE/FRINGE BENEFIT
CERTIFICATION**

(a) Every contractor and subcontractor furnishing work on the Project shall complete a Wage/Fringe Benefit Certification on the form approved by the Indiana Finance Authority and submit this certification to the Labor Standards Administrator prior to commencing work on the Project.

(b) The Provider shall require the substance of this provision to be included in all contracts with subcontractors.

Wage/Fringe Benefit Certification
(To be completed by contractor/subcontractor)

COMMUNITY: Town of Wheatland

PROJECT: Wastewater System Improvements - Division I

This is to certify that

plans to use the following classifications of workers on the above referenced project:

From Applicable Wage Decision				Base Wage to be paid by Contractor	Fringe Benefits to be provided by Contractor		Total package to be paid by Contractor
Classification	Base Wage Due	Fringe Benefits Due	Total Package Due		Benefit	Hourly Amount	

Certified by: _____ **Title:** _____ **Date:** _____

(must be certified by contractor)

EXHIBIT D

**SUSPENSION AND DEBARMENT
PROVISION**

(NO TEXT FOR THIS PAGE)

Attachment E

REQUIRED CONTRACT PROVISION RELATED TO SUSPENSION AND DEBARMENT

Contractor shall fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled “Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons).” Provider is responsible for ensuring that any lower tier covered transaction as described in Subpart B of 2 CFR Part 180 and 2 CFR Part 1532, entitled “Covered Transactions,” includes a term or condition requiring compliance with Subpart C. Contractor is responsible for further requiring the inclusion of a similar term or condition in any subsequent lower tier covered transactions. Contractor may access the Excluded Parties List System at www.epls.gov. This term and condition supersedes EPA Form 5700-49, “Certification Regarding Debarment, Suspension, and Other Responsibility matters.”

(NO TEXT FOR THIS PAGE)

EXHIBIT E

**GREEN PROJECT RESERVE BID
INSTRUCTION AND FORM**

(NO TEXT FOR THIS PAGE)

ATTACHMENT F

REQUIRED INSTRUCTION RELATED TO GPR COMPONENTS

U.S. EPA Green Project Reserve Program

Certain portions or components of this Project, which are described in the GPR Bid Breakdown form furnished with the Bid Documents, qualify for the U.S. EPA Green Project Reserve (GPR) Program and/or the Sustainability Incentive offered by the Indiana State Revolving Fund (SRF) Loan Program. Bidder shall complete the GPR Bid Breakdown form and submit the completed form with its Bid. This information is required by the U.S. EPA and the Indiana SRF Program and **Bidder's failure to fully and accurately complete the GPR Bid Breakdown form and submit it with its Bid may result in the Bid being rejected as non-responsive.**

ATTACHMENT G

**STATE REVOLVING FUND LOAN PROGRAM
GREEN PROJECT RESERVE (GPR) AND SUSTAINABILITY INCENTIVE GPR BID
BREAKDOWN**

Certain portions or components of this Project, which are described below, qualify for the U.S. EPA Green Project Reserve (GPR) Program and/or the Sustainability Incentive offered by the Indiana State Revolving Fund (SRF) Loan Program.

Each Bidder shall provide the dollar amount that Bidder included in its total Bid for each portion or component, including all labor, materials, and equipment necessary to complete each portion or component of the Project Contract.

Non-distributed costs should be listed as its own line item below or incorporated into the price for each GPR Component/Portion.

- Non-distributed costs are defined as costs that are applied to the overall contract, but not to a specific line item/component (e.g. mobilization, demobilization, site work, bonds, insurance)

This information is required by the U.S. EPA and the Indiana SRF Loan Program and Bidder's failure to fully and accurately complete this form and submit it with its Bid may result in the Bid being rejected as non-responsive.

GPR Component Description	GPR Component Price [to be completed by Bidder]
High Service Pumps	
Variable Frequency Drive	
Natural Gas Generator	
Radio Read Meters	
Fixed Network Data Collector	

TOTAL CONSTRUCTION GPR COST: \$ _____

EXHIBIT F

AMERICAN IRON AND STEEL PROVISION AND FORM

ATTACHMENT I

REQUIRED CONTRACT PROVISIONS RELATED TO AMERICAN IRON AND STEEL

The Contractor hereby acknowledges to and for the benefit of the Town of Wheatland (“Owner”) and the Indiana Finance Authority (the “Authority”) that it understands the work, goods and services under this Agreement are being funded with monies made available by the State Revolving Fund Loan Program and such appropriation contains provisions commonly known as “American Iron and Steel” (and as such is supplemented from time to time by federal rules and guidance) that requires all of the iron and steel products used in the project be produced in the United States (“American Iron and Steel Requirements”) including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the Authority, and agrees, that (a) the Contractor has reviewed and understands the American Iron and Steel Requirements, (b) all of the iron and steel products used in the project as provided by the Contractor under this Agreement will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirements and (c) the Contractor will provide any further certification or assurance of compliance with this paragraph as may be requested by the Owner or the Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner and the Authority to recover as damages against the Contractor (and the Contractor shall indemnify and hold the Owner and the Authority harmless against) any loss, expense or cost (including without limitation attorney’s fees) incurred by the Owner or the Authority resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Authority or any damages owed to the Authority 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 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 Authority.

ATTACHMENT J

REQUIRED CERTIFICATION FROM CONTRACTOR RELATED TO AMERICAN IRON AND STEEL

CERTIFICATION

I _____, of _____
(Name and Title of Certifying Officer) (Successful Bidder)

hereby certify and agree on behalf of the Successful Bidder as its duly authorized representative (and under penalties of perjury) that the Successful Bidder understands and agrees a material term and consideration applicable to the award and entry into a contract with the Successful Bidder by the _____ related to its _____

(SRF Applicant)

(Project Name)

involves the procurement and provision of work, goods and services under a procurement contract to be entered into with the SRF Applicant is the Successful Bidder's compliance with the provisions of H.R. 3547, "Consolidated Appropriations Act, 2014" commonly known as "American Iron and Steel" provisions as contained therein requiring that all of the iron and steel products used in the Project be produced in the United States ("American Iron and Steel Requirements"). The Successful Bidder hereby represents and warrants to and for the benefit of the SRF Applicant and the Indiana Finance Authority, as a lender to the SRF Applicant for the funding of its Project, and agrees, that

(a) the Successful Bidder has reviewed and understands the American Iron and Steel Requirements,

(b) all of the iron and steel products used in the Project as provided by the Successful Bidder under its agreement related to the Project will be produced in the United States in a manner that complies with the American Iron and Steel Requirements and (c) the procurement contract will include a provision substantially like Attachment I.

I SWEAR OR AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE ABOVE STATEMENTS ARE TRUE TO THE BEST OF MY KNOWLEDGE.

(Signature)

(Date)

STATE OF _____)
) SS:
COUNTY OF _____)

Before me, a Notary Public in and for said County and State, personally appeared _____, the _____ of _____ who, being first duly sworn, acknowledged the execution of the above and foregoing instrument for and on behalf of said entity.

Dated this ____ day of _____, 2014.

My commission expires:

_____, Notary Public
(Printed)

County of Residence:

EXHIBIT G

DBE PROGRAM REQUIREMENTS AND FORM

INDIANA STATE REVOLVING FUND LOAN PROGRAM DBE PACKET

This packet lists required contract conditions that apply to all Clean Water and Drinking Water State Revolving Fund projects and contains forms that must be used in the procurement process. This packet must be physically included in all bidding and contract documents.

This project is being financed in whole or in part by the Indiana State Revolving Fund Loan Programs. The loan recipient is required to comply with the following federal and state laws, rules and regulations and must ensure that their contractor(s) also comply with these regulations, laws and rules.

1. Title VI of the Civil Rights Act of 1964 (P.L 88-352), the Rehabilitation Act of 1973 (P.L. 93-1123, 87 Stat. 355, 29 U.S.C. Sec. 794), the Older Americans Amendments of 1975 (P.L. 94-135 Sec. 303, 89 Stat. 713, 728, 42 U.S.C. Sec. 6102), and subsequent regulations, ensures access to facilities or programs regardless of race, color, national origin, sex, age or handicap.
2. Executive Orders 11246, as amended by Executive Orders 11375 and 12086 and subsequent regulations. Prohibits employment discrimination on the basis of race, color, religion, sex or national origin. Inclusion of the seven clauses in Section 202 of E. O. 11246 as amended by E. O. 11375 and 12086 are required in all project related contracts and subcontracts over \$10,000.
3. 40 CFR Part 33 Participation by Disadvantaged Business Enterprises in Procurement under Environmental Protection Agency (EPA) Financial Assistance Agreements
4. Executive Orders 11625, 12138 and 12432; 40 CFR part 33; Section 129 of P. L. 100-590 Small Businesses Reauthorization & Amendment Act of 1988; Public Law 102-389 (42 U.S.C. 437d); a 1993 appropriations act (“EPA’s 8% statute”); Public Law 101-549, Title X of the Clean Air Acts Amendments of 1990 (42 U.S.C. 7601 note) (“EPA’s 10% statute”). Encourages recipients to award construction, supply and professional service contracts to minority and women’s business enterprises (MBE/WBE) and small businesses and requires recipients to utilize affirmative steps in procurement.
5. Executive Order 12549 and 40 CFR Part 32, Subparts B and C. Prohibits entering into contracts or sub-contracts with individuals or businesses who are debarred or suspended. Borrowers are required to check the status of all contractors (construction and professional services) and must require contractors to check the status of subcontractors for contracts expected to be equal to or over \$25,000 via this Internet address: www.sam.gov
6. Indiana Code 36-1-12-12, Requires the board to withhold final payment to contractor until the contractor has paid the subcontractors, material suppliers, laborers, or those furnishing services
7. Indiana Code 36-1-12-13.1, requires performance and payments bonds equal to 100% of the contract price if the cost of the public work is estimated to be more than \$200,000.

Equal Employment

Inclusion of these seven clauses (excerpt from Executive Order No. 11246, Section 202 as amended by

Executive Order 11375 and 12086) is required in all CWSRF and DWSRF project related contracts and subcontracts over \$10,000:

During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.
2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
3. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or worker's representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
4. The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and all of the rules, regulations, and relevant orders of the Secretary of Labor.
5. The contractor will furnish all information and reports required by Executive Order No. 11246 of Sept. 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
6. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of Sept. 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
7. The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of Sept. 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a

means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Disadvantaged Business Enterprises (DBE) Good

Faith Efforts

Borrowers and their prime contractors must follow, document, and maintain documentation of their good faith efforts to meet the MBW/WBE goals as listed below to ensure that Disadvantage Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach. In order to become a certified DBE under this rule, an eligible entity must submit an application that can be found by visiting: <https://www.in.gov/idoa/mwbe>

The fair share goal of contracts and subcontracts to be awarded to MBEs and WBEs and their participation in the Contractor’s aggregate workforce in each trade on all construction work for the subject project are as follows:

MBEs	<u>7 %</u>
WBEs	<u>5 %</u>

1. Ensure DBEs 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.
2. 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. This includes, whenever possible, posting solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could be subcontracted with DBEs. This will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
4. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U. S. Department of Commerce.
5. If the prime contractor awards subcontracts, require the prime contractor to take the steps in numbers 1 through 5 above.

Required Contract Conditions

These conditions must be included in all procurement contracts entered into by the loan recipient for all DWSRF and CWSRF projects:

1. The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the loan recipient.
2. The prime contractor must notify the loan recipient in writing prior to the termination of any DBE subcontractor for convenience by the prime contractor.
3. If a DBE subcontractor fails to complete work under the subcontract for any reason, the prime contractor must employ the six good faith efforts if soliciting a replacement subcontractor.
4. The prime contractor must employ the six good faith efforts even if the prime contractor has achieved its fair share objectives.
5. Each procurement contract signed must include 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 or other legally available remedies.”

U.S. ENVIRONMENTAL PROTECTION AGENCY

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to federally assisted construction contracts and related subcontracts exceeding \$10,000 which are not exempt from the Equal Opportunity clause.)

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term segregated facilities means any waiting rooms, work areas, rest rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or nation origin, because of habit, local custom, or otherwise. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certification in his files.

Signature

Date

Name and Title of Signer (Please type)

Firm Name

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

OEE-1 (11/79)

NOTICE TO LABOR UNIONS OR OTHER ORGANIZATIONS OF WORKERS
NONDISCRIMINATION IN EMPLOYMENT

TO: _____
(Name of union or organization of workers)

The undersigned currently holds contract(s) with _____
(Name of Applicant)
involving funds or credit of the U.S. Government or (a) subcontract(s) with a prime contractor holding such contract(s).

You are advised that under the provisions of the above contract(s) or subcontract(s) and in accordance with Executive Order 11246, as amended, dated September 24, 1965, as amended, the undersigned is obliged not to discriminate against any employee or applicant for employment because of race, color, creed, or national origin. This obligation not to discriminate in employment includes, but is not limited to, the following:

HIRING, PLACEMENT, UPGRADING, TRANSFER, OR DEMOTION,
RECRUITMENT, ADVERTISING, OR SOLICITATION FOR
EMPLOYMENT, TRAINING DURING EMPLOYMENT, RATES OF PAY OR
OTHER FORMS OF COMPENSATION, SELECTION FOR TRAINING
INCLUDING APPRENTICESHIP, LAYOFF OR TERMINATION.

This notice is furnished you pursuant to the provisions of the above contract(s) or subcontract(s) and Executive Order 11246, as amended.

Copies of this notice will be posed by the undersigned in conspicuous places available to employees or applicants for employment.

(Contractor or Subcontractor)

(Date)

**Public Works and Indiana Finance Authority
GOOD FAITH EFFORTS WORKSHEET**

BIDDER _____

BID/PROJECT NUMBER _____

CONTRACT GOALS 7% MBE 5% WBE

List the M/WBEs contacted and complete the following information for each. Copies of all communications to and from each vendor should be maintained.*

Company Name and Address	MBE	WBE	Type of Contact	Date of Contact	Date Response Due	Goods Or Services Requested	Result (Include Price Quote)

Indicate **Good Faith Efforts** made to utilize MWBEs. Check and explain all that apply or should be considered. Please provide evidence of the efforts that you want to be considered. A complete description of each criteria may be found in the **Indiana Department of Administration Public Works and State Office Building Commission MWBE Participation Policy**.

MBE and WBE Barrier Assistance	Describe
Advertisement	Describe
Agency Assistance	Describe
Other Criteria	Describe

* Copies of all communication to and from each vendor should also be attached to this Worksheet and submitted to SRF for review.

Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Performance Form

This form is intended to capture the DBE¹ subcontractor's² 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 contractor's 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.

**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.

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 DBE¹ subcontractors² 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.

**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.

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and Drawing conventions.
6. Constraints.
7. Work sequence.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: Wheatland Wastewater System Improvements Division I – Wastewater Treatment Plant and Regional Lift Station.

1. Project Location: Wheatland, Indiana.

- B. Owner: Town of Wheatland, P.O.Box 219, Wheatland, Indiana, 47597.

- C. Engineer: RQAW Corporation, 8770 North St., Suite 110, Fishers, Indiana, 46038.

- D. Engineer's Consultants: Engineer has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Geotechnical Report: Atlas Technical Consultants LLC, 7988 Centerpoint Dr, Ste. 100, Indianapolis, IN, 46256

2. It is the responsibility of the Contractor to coordinate with the Engineer on all project related items. Engineer will coordinate with Engineer's Consultants as required.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 1. The project includes installation of a complete lift station, construction and startup of a n AeroMod brand package extended aeration plant with a design flow of 58,600 gallons per day, construction and startup of a UV disinfection system and post-aeration system, refinishing an existing pole barn space to outfit it with necessary equipment, various potential alternates, and all other associated work as required by the Contract Documents to provide a fully operational wastewater treatment system within the Town of Wheatland, IN.
- B. The Work includes:
 1. Furnishing of all labor, material, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.
 2. Sole responsibility for adequacy of equipment.
 3. Maintaining the Work area and site in a clean and acceptable manner.
 4. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.
 5. Protection of finished and unfinished Work.
 6. Repair and restoration of Work damaged during construction.
 7. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.
- C. Implied and Normally Required Work: It is the intent of these Specifications to provide the Owner with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.
- D. Quality of Work: Regard the apparent silence of the Contract Documents as to any

detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these Specifications will be made upon this basis.

E. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, Residents, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 - c. Do not block or prevent entry to driveways and entrances of adjacent property owners throughout the duration of the project.
- C. Condition of Existing Buildings: Maintain portions of existing buildings at or adjacent to the site affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to normal business working hours as described in the Supplementary Conditions.

- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than 48 hours in advance of proposed utility interruptions.
 - 2. Obtain Engineer's written permission before proceeding with utility interruptions.

- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Engineer not less than 48 hours in advance of proposed disruptive operations.
 - 2. Obtain Engineer's written permission before proceeding with disruptive operations.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

- D. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 1. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and as scheduled on Drawings.

1.8 CONSTRAINTS

- A. The Contract Documents are intended to allow the Contractor flexibility in construction of the Work however the following constraints apply:

1. Repair or replace any portions of the distribution and new collection system which are damaged by the Contractor. Any such repairs or replacements shall be performed at no additional cost to the Owner.
 2. The Engineer is the sole judge of when the Contractor's operations are causing interference with the Owner's daily procedures. The Engineer's orders and instructions on alleviating such interferences will be carried out without delay.
 3. Perform the work in strict accordance within the construction limits shown.
 4. CAUTION: Asbestos-cement dust is hazardous if inhaled. Take proper precautions at all times when handling and cutting asbestos-cement transite pipe. Dispose of asbestos-cement transite pipe according to OSHA guidelines.
- B. Coordinate in advance with the Owner all interruptions to existing systems and facilities. In the event of a conflict, Contractor will reschedule his operations so that the Work will not conflict with Owner's necessary operations or maintenance.
- C. Perform connections to existing facilities or systems that interfere with the operation of existing facilities or systems as quickly as possible and with as little delay as possible.
- 1.9 WORK SEQUENCE
- A. Coordinate work of all subcontractors.
- B. Submit for acceptance a detailed sequence of construction with the construction schedule prior to the Work commencing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 STARTING WORK

- A. Start Work within 10 days following the date stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project and with such forces, material and equipment, as to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION 01 10 00

(NO TEXT FOR THIS PAGE)

SECTION 01 20 00 - CONTRACT ITEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Section includes the Contract Items for the Project.

1.2 CONTRACT ITEM 1 – WASTEWATER TREATMENT PLANT AND REGIONAL LIFT STATION, COMPLETE

- A. Description: The Work under this Contract Item includes providing all labor, materials, equipment, supplies and services, and performing all Work for installation, maintenance, testing, and placing into the trouble-free operation the designed Wastewater Treatment Plant along with all associated equipment, UV disinfection unit, post-aeration unit, renovated pole barn building, and regional lift station. The Work includes, but may not be limited to, all general, architectural, structural, mechanical, plumbing, electrical and instrumentation and control work complete in place, together with all appurtenant Work as shown and specified.
- B. Payment: Payment under Item 1 will be made as a Contract Lump Sum Price.

1.3 CONTRACT ITEM 2 – MANDATORY BID ALTERNATE NO. 1 – POLE BARN ROOF AND RAFTER REPAIRS

- A. Description: The work under this Contract Item includes demolition of decaying rafters, removing the existing metal roof structure, and installing replacement rafters and a new roof structure as indicated on the plans and specified herein.
- B. Payment: Payment under Item 2 will be made as a Contract Lump Sum Price.

1.4 CONTRACT ITEM 3 - MANDATORY BID ALTERNATE NO. 2 – POLE BARN OFFICE AND RESTROOM BUILDOUT

- A. Description: The Work under this Contract Item includes additional walls, plumbing, and furnishing as described in the architectural, plumbing, mechanical, and electrical drawings and as specified herein. The work includes but may not be limited to installing walls and finishes for an office space, storage closet, and restroom within the existing pole barn site building.
- B. Payment: Payment under Item 3 will be made as a Contract Lump Sum Price.

- 1.5 CONTRACT ITEM 4 – MANDATORY BID ALTERNATE NO. 3 – SLUDGE DRYING BED
- A. Description: The Work under this Contract Item includes the construction of a sludge drying bed as depicted and specified on the drawings. The work includes, but may not be limited to, the installation of the section of pipe connecting the sludge storage tank to the sludge drying bed, pumps to move sludge to drying bed, sludge drying bed effluent structure, sludge drying bed base, walls, and prefabricated metal building.
 - B. Payment: Payment under Item 4 will be made as a Contract Lump Sum Price.
- 1.6 CONTRACT ITEM 4 – MANDATORY BID ALTERNATE NO. 4 – WWTP SITE FENCING AND SLIDE GATE
- A. Description: The Work under this Contract Item includes the construction of a proposed fence and slide gate for second entrance as depicted and specified on the drawings. The work includes, but may not be limited to, the demolition of portions of the existing fence.
 - B. Payment: Payment under Item 4 will be made as a Contract Lump Sum Price.

END OF SECTION 01 20 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Engineer in accordance with the General Conditions.
 - 3. Identify site mobilization, bonds and insurance.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of EJCDC Document C-620.
 - 3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.

- b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Submittals.
 - 2) Labor.
 - 3) Materials.
 - 4) Equipment.
 - 5) Start-up/Testing.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
 5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 6. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
 7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
- B. Payment Application Times: Submit draft Application for Payment to Engineer by the second Tuesday of the month. The period covered by each Application for Payment is one month, ending on the Friday prior to the second Tuesday of each month. Application for Payment must be agreed to and approved on the Friday before the third Tuesday of the month for payment at the monthly Town Council Meeting.
- C. Application for Payment Forms: Use EJCDC Document C-620 as form for Applications for Payment.

- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Do not include an Application for Payment for materials or equipment purchased or fabricated and stored, but not yet installed. Pay will be based on installed units.
- F. Transmittal: Submit four signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt. Include waivers of lien and similar attachments with each copy.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Lien: With each Application for Payment, except for the first, submit waivers of lien from entities lawfully entitled to a lien.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Submittal schedule (preliminary if not final).

6. Copies of building permits.
 7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 8. Initial progress report.
 9. Report of preconstruction conference.
- I. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. Indiana State Form 34951
 5. Evidence that claims have been settled.
 6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 7. Final liquidated damages settlement statement.
- K. Record Drawings: Keep all record drawings current. Recommendation for payment of pay application is subject to Engineer's review and confirmation that all record drawings are up to date.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 19 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION CONFERENCE

- A. The Engineer will schedule meeting after Notice of Award.
- B. Attendance Required: Owner, Engineer, Contractor, and Subcontractors.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreements.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of schedule of values and progress schedule.
 - 5. Designation of personnel representing Owner, Engineer, and Contractor.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Use of premises by Owner and Contractor.
 - 8. Owner's requirements.
 - 9. Construction facilities and controls.
 - 10. Temporary utilities.
 - 11. Survey.
 - 12. Security and housekeeping procedures.
 - 13. Procedures for testing.
 - 14. Procedures for maintaining record documents.
 - 15. Requirements for bringing new equipment into service.
 - 16. Inspection and acceptance of equipment put into service during construction period.
- D. The Engineer will record minutes and distribute copies to participants and those affected by decisions made.

1.2 PROGRESS MEETINGS

- A. The Contractor will schedule and administer meetings throughout progress of the Work at maximum monthly intervals.
- B. The Contractor will arrange and preside at meetings. For these meetings, the contractor will create an agenda and provide participants with a copy.

- C. Attendance Required: Job superintendents, major subcontractors and suppliers, Owner, and Engineer, as appropriate to agenda topics for each meeting.

- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Progress to date.
 - 3. Anticipated progress until next progress meeting.
 - 4. Identification of problems impeding planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Maintenance of progress schedule.
 - 7. Corrective measures to regain projected schedules.
 - 8. Review of Requests for Information (RFI's).
 - 9. Review of Requests for Proposal (RFP's).
 - 10. Review of Change Orders (CO's).
 - 11. Review of Pay Applications.
 - 12. Owner discussions, concerns, and comments.
 - 13. Engineer discussions, concerns, and comments.
 - 14. Other business relating to Work.

- E. The Contractor will record minutes and distribute copies to participants and those affected by decisions made.
 - 1. Distribute meeting notes to attendees within seven calendar days after each meeting and allow three days for review of meeting notes by all parties. After the three-day review period, re-distribute notes as required and prior to the next progress meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 19

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
- 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
- 2. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
- 3. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
- 4. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
- 5. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
- 6. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule within 5 calendar days from Notice to Proceed. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Engineer's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Engineer.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.

7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.
 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.
 16. Signature of transmitter.
- B. Options: Identify options requiring selection by Engineer.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 3. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using facsimile of sample form included in Project Manual transmittal form.
- 1.6 SUBMITTAL PROCEDURES
- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. ShareFile/FTP Website: Prepare submittals in PDF form, and upload to a ShareFile or FTP website. Enter required data in web-based software site to fully identify submittal.
 - a. Engineer will review and upload an annotated file to the web-based system.

- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - C. Processing Time: Allow time for submittal review, including time for resubmittals, as indicated in the General and Supplementary Conditions. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
 - E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
 - F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.
- 1.7 SUBMITTAL REQUIREMENTS
- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. Mark each copy of each submittal to show which products and options are specific to the project.
 2. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 3. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
 3. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 4. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.

- c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
5. Paper Transmittal: Include paper transmittal including complete submittal information indicated. Upload a copy of the transmittal to the ShareFile or FTP website for record keeping purposes.
 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit three full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
 8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Engineer will retain two Sample sets; remainder will be returned with Engineer comments.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

- C. **Product Schedule:** As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- D. **Qualification Data:** Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, reference contact information, and other information specified.
- E. **Design Data:** Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- F. **Certificates:**
1. **Certificates and Certifications Submittals:** Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. **Installer Certificates:** Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. **Manufacturer Certificates:** Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. **Material Certificates:** Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 5. **Product Certificates:** Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- G. **Welding Certificates:** Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ENGINEER'S REVIEW

- A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required and return it.
 1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action as follows:
 - a. No Exceptions Taken:
 - 1) Where submittals are stamped "No Exceptions Taken". Work covered by submittal may proceed PROVIDED THE WORK COMPLIES WITH THE CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.
 - b. Make Corrections Noted:
 - 1) When submittals are stamped "Make Corrections Noted". Work covered by submittal may proceed PROVIDED IT COMPLIES WITH ENGINEER'S NOTATIONS AND CORRECTIONS ON SUBMITTAL AND WITH THE CONTRACT DOCUMENTS. Acceptance of Work will depend on that compliance.
 - c. Submit Specified Item:

- 1) When submittals are stamped "Submit Specified Item" Contractor may proceed with Work covered by the submittal, except for the requested item, PROVIDED THE WORK COMPLIES WITH THE CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.
 - 2) Submit the requested item in accordance with Paragraph 1.7 of this Section.
- d. Revise and Resubmit:
- 1) When submittals are stamped "Revise and Resubmit" do not proceed with Work covered by submittal. Do not permit Work covered by submittal to use at Project site or elsewhere where Work is in progress.
 - 2) Revise submittal in accordance with Engineer's notations.
- e. Rejected:
- 1) When submittals are stamped "Rejected" do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.
 - 2) Provide a new submittal that meets the intent of the Specifications and in accordance with Engineer's notations.
- B. Informational Submittals
1. When Informational Submittals conform to the format requirements in the Contract Documents, Engineer will acknowledge such submittals via a response transmittal.
 2. If an Information Submittal does not conform to the format requirements of the Contract Documents, Engineer will return the submittal with comments or questions. Do not proceed with Work covered by the submittal and do not permit Work covered by the submittal to be used at Project site or elsewhere where Work is in progress. Resubmit the Information Submittal until the Engineer acknowledges that the submittal conforms to the format required.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval in writing from Engineer.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Engineer will return without review submittals received from sources other than Contractor.

- F. Submittals not required by the Contract Documents will be returned by Engineer without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUBMITTAL NUMBERING

- A. Number all submittals as follows:

(A) - (B)

Where:

(A) = Specification Section Number

(B) = Consecutive submittal number for the Specification Section Number listed in (A), with an alphabetic suffix indicating the sequential version of the submittal.

Examples:

01 33 00-001A indicates the initial version of submittal number 001 for Specification Section 01 33 00.

01 33 00-001B indicates the second version of submittal number 001 for Specification Section 01 33 00.

01 33 00-002A indicates the initial version of submittal number 002 for Specification Section 01 33 00.

3.2 REPETITIVE REVIEWS

- A. Repetitive Reviews: Submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at times convenient to the Engineer based on the Engineer's then prevailing rates including all direct and indirect costs and fees. Contractor is not entitled to an increase in the Guaranteed Maximum Price for reimbursing Owner for all such costs and fees invoiced for third and subsequent submittals.

3.3 EXAMPLE FORMAT FOR CONTRACTOR'S APPROVAL AND CERTIFICATION STAMP

- A. An example format for the Contractor's approval and certification stamp is as follows:

<p>CONTRACTOR'S NAME</p> <p>___ Approved and Certified to comply with the Contract Documents</p> <p>___ Approved and Certified to comply with Contract Documents, except for variations specifically noted on the Submittal Transmittal Form and the associated documents.</p> <p>PRINTED NAME: _____</p> <p>TITLE: _____</p> <p>SIGNATURE: _____</p> <p>DATE: _____</p>
--

3.4 CONTRACTOR'S SUBMITTAL TRANSMITTAL FORM

- A. The format for the Contractor's Submittal Transmittal form is as follows:

SUBMITTAL TRANSMITTAL FORM
Wheatland Wastewater System – Division I

TO: _____ DATE: _____
 ATTN: _____ SITE: _____
 FROM: _____ SPEC. REF. NO.: _____
 DWG REF. NO.: _____
 SUBMITTAL NO.: _____

1. The following documents are forwarded for your review:

No. of Copies	Document Originator	Description	Document No.	Date

2. Will item submitted for review fit in space provided in the Contract Document? _____ Yes _____ No _____ Not Applicable
3. Has work indicated in this submittal been coordinated with all trades? _____ Yes _____ No _____ Not Applicable
4. Has the Contractor approved submittal and affixed completed approval and certification stamp? _____ Yes _____ No
5. Contractor's description and justification for variations from the Contract Documents. (Use additional pages, if necessary)

6. Remarks: _____

Printed Name: _____

Signature: _____

3.5 SUBMITTAL REQUIREMENTS

- A. The schedule of submittals below is to be used only as a guide and is not guaranteed as a complete listing. Furnish submittals for any items of material or equipment required by the Technical Specifications.

SECTION	ITEM DESCRIPTION	INFORMATIONAL SUBMITTAL	SHOP DRAWING PRODUCT DATA / LAYOUT DRAWINGS	INSTALLATION INSTRUCTIONS	DESIGN CALCULATIONS AND / OR PE APPROVALS	O&M MANUAL	START-UP REPORT	MANUFACTURERS WARRANTY / CERTIFICATION OF INSTALLATION	SAMPLES AND/OR CERTIFIED TEST REPORTS	DAYS DUE AFTER NOTICE TO PROCEED
01 20 00	INDOT Settlement Monitoring Plan – SR 550 ROW	X	X		X					
01 33 00	Submittal Procedures – Submittal Schedule	X								5
01 40 00	Quality Requirements	X								
01 50 00	Temporary Facilities and Controls	X								
01 60 00	Product Requirements	X								
01 77 00	Closeout Procedures	X	X							
01 78 23	Operation and Maintenance Data	X								
01 78 39	Project Record Documents	X								
01 79 00	Demonstration and Training	X								
02 41 19	Selective Demolition	X								
03 10 00	Concrete Formwork		X							
03 20 00	Concrete Reinforcing		X							
03 30 00	Cast-in-Place Concrete		X						X	
07 21 00	Thermal Insulation		X							
07 61 00	Sheet Metal Roofing		X						X	
08 11 13	Hollow Metal Doors and Frames		X						X	
08 39 19	Sanitary and Watertight Doors and Frames	X	X						X	
08 53 13	Vinyl Windows	X	X					X		
08 71 00	Door Hardware	X	X							
09 21 16	Gypsum Board Assemblies		X							

SECTION	ITEM DESCRIPTION	INFORMATIONAL SUBMITTAL	SHOP DRAWING PRODUCT DATA / LAYOUT DRAWINGS	INSTALLATION INSTRUCTIONS	DESIGN CALCULATIONS AND / OR PE APPROVALS	O&M MANUAL	START-UP REPORT	MANUFACTURERS WARRANTY / CERTIFICATION OF INSTALLATION	SAMPLES AND/OR CERTIFIED TEST REPORTS	DAYS DUE AFTER NOTICE TO PROCEED
09 91 23	Interior Painting		X						X	
12 35 53.13	Metal Laboratory Casework		X						X	
12 36 61.16	Solid Surfacing Countertops		X						X	
22 05 01	Common Work Results for Plumbing		X							
22 05 02	Selective Demolition	X								
22 05 08	Piping Expansion Compensation	X	X	X						
22 05 19	Meters and Gauges	X	X							
22 05 23	Duty Valves	X	X							
22 05 29	Hangers and Supports		X							
22 05 53	Pipe and Equipment Identification		X						X	
22 07 00	Plumbing Pipe Insulation		X							
22 11 16	Domestic Water Piping and Devices		X							
22 11 99	PEX Piping		X							
22 13 16	Sanitary Waste and Vent Piping		X							
22 40 00	Plumbing Fixtures		X							
23 00 00	Common Requirements of HVAC	X					X			
23 31 13	Metal Ducts		X				X			
23 33 00	Air Duct Accessories		X							
23 34 23	HVAC Power Ventilators		X				X			
23 37 01	Extruded Aluminum Stationary Louvers		X						X	
23 37 13	Diffusers, Registers, and Grills		X						X	
23 81 26	Ductless Split Systems		X				X			
23 82 39.19	Wall Unit Heaters		X				X			
25 13 00	Instrumentation on Control		X			X	X		X	

SECTION	ITEM DESCRIPTION	INFORMATIONAL SUBMITTAL	SHOP DRAWING PRODUCT DATA / LAYOUT DRAWINGS	INSTALLATION INSTRUCTIONS	DESIGN CALCULATIONS AND / OR PE APPROVALS	O&M MANUAL	START-UP REPORT	MANUFACTURERS WARRANTY / CERTIFICATION OF INSTALLATION	SAMPLES AND/OR CERTIFIED TEST REPORTS	DAYS DUE AFTER NOTICE TO PROCEED
25 30 00	Field Mounted Instruments	X	X			X	X	X	X	
25 30 10	Instrument Panel Construction	X	X			X	X	X		
25 30 20	Process Controllers and Computer System	X	X			X	X	X		
26 05 19	Low Voltage Electrical Power Cables		X				X			
26 05 20	Control Voltage Electrical Power Cables		X				X			
26 05 26	Grounding and Bonding for Electrical Systems		X				X			
26 05 29	Hangers and Supports for Electrical Systems		X	X						
26 05 33	Raceways and Fittings		X	X						
26 05 53	Identification for Electrical Systems		X	X						
26 24 15	Distribution Panelboards		X					X		
26 27 26	Wiring Devices		X					X		
26 28 13	Fuses		X			X				
26 28 16	Enclosed Switches and Circuit Breakers		X			X			X	
26 29 13	Enclosed Controllers		X			X			X	
26 29 23	Variable Frequency Motor		X	X	X	X		X		
26 32 13	Generators		X			X	X	X	X	
26 36 00	Transfer Switches		X						X	
26 43 14	Surge Protective Devices		X	X				X		
31 23 23	Fill	X							X	
32 25 00	Erosion and Sedimentation Controls		X	X						
33 05 13	Precast Concrete Wastewater Structures		X						X	

SECTION	ITEM DESCRIPTION	INFORMATIONAL SUBMITTAL	SHOP DRAWING PRODUCT DATA / LAYOUT DRAWINGS	INSTALLATION INSTRUCTIONS	DESIGN CALCULATIONS AND / OR PE APPROVALS	O&M MANUAL	START-UP REPORT	MANUFACTURERS WARRANTY / CERTIFICATION OF INSTALLATION	SAMPLES AND/OR CERTIFIED TEST REPORTS	DAYS DUE AFTER NOTICE TO PROCEED
33 05 13	Reinforced Concrete Sewer Pipe		X						X	
33 05 52	Sanitary Sewer		X						X	
33 31 20	Force Main		X						X	
33 32 19	Public Utility Wastewater Pumping Stations		X			X	X		X	60
46 07 53	Wastewater Treatment Package Plant		X	X	X	X	X	X	X	
46 66 56	UV Disinfection Equipment		X	X	X	X	X	X	X	

END OF SECTION 01 33 00

(NO TEXT FOR THIS PAGE)

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

- D. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
 - E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
 - F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
 - G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
 - H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
 - I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
 - J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Engineer.
- 1.4 DELEGATED-DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

1.5 CONFLICTING REQUIREMENTS

- A. **Conflicting Standards and Other Requirements:** If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.6 INFORMATIONAL SUBMITTALS

- A. **Testing Agency Qualifications:** For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
 - 1. Specification section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- C. **Reports:** Prepare and submit certified written reports and documents as specified.
- D. **Permits, Licenses, and Certificates:** For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

- A. **Test and Inspection Reports:** Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

1.8 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1.9 QUALITY CONTROL

- A. Contractor Responsibilities: Tests and inspections are contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 3. Notify testing agencies at least 48 hours in advance of time when work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Field and Laboratory Tests: Provide personnel to perform the following periodic observation and associated services:
1. Soils: Observe and test excavations, placement, and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.
 2. Concrete: Observe forms and reinforcement; observe concrete placement; perform and facilitate air entrainment and slump tests, and concrete cylinder preparation.
 3. Asphalt: Observe and test placement and compaction of asphalt. Observe subgrade soils to determine suitability for placement.
 4. Provide at least a 24-hour notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the Engineer and the testing laboratory.
- C. Retesting/Reinspecting: Retest and reinspect construction that replaced work that failed to comply with the Contract Documents. Costs for retesting or reinspecting the work shall be incurred by the Contractor at no expense to the Owner.

- D. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Security and protection for samples and for testing and inspection equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 COSTS OF INSPECTION

- A. Contractor's Obligation: Include in the Contract Price, the cost of all shop and field tests of materials and equipment specifically called for in the Contract Documents. The Owner may perform tests on any material furnished under this Contract at any time during the Contract. If tests performed by the Owner result in failure or rejection for noncompliance, reimburse the Owner for expenditures incurred in making such tests. Tests performed by the Owner shall prevail in determining compliance with Contract requirements.
- B. Reimbursements to Owner:

1. Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. Reimburse the Owner for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.

1.11 ACCEPTANCE TESTS

- A. Preliminary Field Tests: As soon as conditions permit, furnish all labor and materials and services to perform preliminary field tests of all equipment provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, make all changes, adjustments and replacements required prior to the acceptance tests.
- B. Final Field Tests: Upon completion of the Work and prior to final payment, subject all equipment, piping and appliances installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.
 1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments, and services necessary for all acceptance tests.
 2. Conduct field tests in the presence of the Engineer. Perform the field tests to demonstrate that under all conditions of operation each equipment item:
 - a. Has not been damaged by transportation or installation.
 - b. Has been properly installed.
 - c. Has been properly lubricated.
 - d. Has no electrical or mechanical defects.
 - e. Is in proper alignment.
 - f. Has been properly connected.
 - g. Is free of overheating of any parts.
 - h. Is free of all objectionable vibration.
 - i. Is free of overloading of any parts.
 - j. Operates as intended.
- C. Certificate of Compliance: Submit a notarized Certificate of Compliance for each equipment item. Provide Certificates in the form of a letter stating the following:
 1. Manufacturer has performed all required tests.
 2. Materials to be supplied meet all test requirements.
 3. Tests were performed not more than one year prior to submittal of the certificate.
 4. Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified.
 5. Identification of the materials.

- D. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the Owner, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the Contractor to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.12 FAILURE TO COMPLY WITH CONTRACT

- A. Unacceptable materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, do not deliver said material or equipment, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the Owner. Fulfill all obligations under the terms and conditions of the Contract even if the Owner or the Resident Project Representative fail to ascertain noncompliance or notify the Contractor of noncompliance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

- A. The following list of Testing Agencies are considered to be pre-approved and acceptable to perform the designated tests and inspections:
1. Earth Exploration
 2. Alt & Witzig
 3. ATC Group Services
 4. CTL Engineering
- B. Contractor may submit the qualifications of an alternate agency for approval by the Engineer.

3.2 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Engineer.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.3 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

(NO TEXT FOR THIS PAGE)

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 - 8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org
 - 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 12. AGA - American Gas Association; www.aga.org.
 - 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 16. AIA - American Institute of Architects (The); www.aia.org.
 - 17. AISC - American Institute of Steel Construction; www.aisc.org.

18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>
51. CEA - Canadian Electricity Association; www.electricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.

53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa.ca.
65. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHI - Door and Hardware Institute; www.dhi.org.
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsintstitute.org.
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.

91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. IAS - International Approval Services; (See CSA).
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IDEM - Indiana Department of Environmental Management; www.in.gov/idem/.
107. IEC - International Electrotechnical Commission; www.iec.ch.
108. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
109. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
110. IESNA - Illuminating Engineering Society of North America; (See IES).
111. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
112. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
113. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; www.itu.int/home.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.

128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHIA - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; www.marble-institute.com.
131. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.
137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
139. NBI - New Buildings Institute; www.newbuildings.org.
140. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
141. NCMA - National Concrete Masonry Association; www.ncma.org.
142. NEBB - National Environmental Balancing Bureau; www.nebb.org.
143. NECA - National Electrical Contractors Association; www.necanet.org.
144. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
145. NEMA - National Electrical Manufacturers Association; www.nema.org.
146. NETA - InterNational Electrical Testing Association; www.netaworld.org.
147. NFHS - National Federation of State High School Associations; www.nfhs.org.
148. NFPA - National Fire Protection Association; www.nfpa.org.
149. NFPA - NFPA International; (See NFPA).
150. NFRC - National Fenestration Rating Council; www.nfrc.org.
151. NHLA - National Hardwood Lumber Association; www.nhla.com.
152. NLGA - National Lumber Grades Authority; www.nlga.org.
153. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
154. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
155. NRCA - National Roofing Contractors Association; www.nrca.net.
156. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
157. NSF - NSF International; www.nsf.org.
158. NSPE - National Society of Professional Engineers; www.nspe.org.
159. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
160. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
161. NWFA - National Wood Flooring Association; www.nwfa.org.
162. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
163. PDI - Plumbing & Drainage Institute; www.pdionline.org.
164. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); <http://www.plasa.org>.
165. RCSC - Research Council on Structural Connections; www.boltcouncil.org.

166. RFCI - Resilient Floor Covering Institute; www.rfci.com.
167. RIS - Redwood Inspection Service; www.redwoodinspection.com.
168. SAE - SAE International; www.sae.org.
169. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
170. SDI - Steel Deck Institute; www.sdi.org.
171. SDI - Steel Door Institute; www.steeldoor.org.
172. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
173. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
174. SIA - Security Industry Association; www.siaonline.org.
175. SJI - Steel Joist Institute; www.steeljoist.org.
176. SMA - Screen Manufacturers Association; www.smainfo.org.
177. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
178. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
179. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
180. SPIB - Southern Pine Inspection Bureau; www.spib.org.
181. SPRI - Single Ply Roofing Industry; www.spri.org.
182. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
183. SSINA - Specialty Steel Industry of North America; www.ssina.com.
184. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
185. STI - Steel Tank Institute; www.steeltank.com.
186. SWI - Steel Window Institute; www.steelwindows.com.
187. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
188. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
189. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
190. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
191. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
192. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
193. TMS - The Masonry Society; www.masonrysociety.org.
194. TPI - Truss Plate Institute; www.tpinst.org.
195. TPI - Turfgrass Producers International; www.turfgrasssod.org.
196. TRI - Tile Roofing Institute; www.tilerroofing.org.
197. UL - Underwriters Laboratories Inc.; <http://www.ul.com>.
198. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
199. USAV - USA Volleyball; www.usavolleyball.org.
200. USGBC - U.S. Green Building Council; www.usgbc.org.
201. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
202. WA - Wallcoverings Association; www.wallcoverings.org
203. **WASTEC - Waste Equipment Technology Association; www.wastec.org.**
204. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
205. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.

206. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 207. WI - Woodwork Institute; www.wicnet.org.
 208. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 209. WWPA - Western Wood Products Association; www.wwpa.org.
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

(NO TEXT FOR THIS PAGE)

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" restrictions and limitations on utility interruptions.
 - 2. Section 31 25 00 "Erosion and Sedimentation Controls" for disposal of ground water at Project site.

1.3 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 °C
 - 2. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.4 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner and Owner's staff, Engineer, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: No sewer utilities are available in the project area until completion of the Division II work.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Provide water and electric meters for water and electric power services connections. Coordinate with Owner on whether a specific meter type is required for monitoring service.

1.5 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

1.6 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
- B. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats minimum 36 by 60 inches.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Contractor's Office: Erect, furnish, and maintain a field office. Have an authorized agent present at this office at all times while the Work is in progress. Keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings at this field office.
- C. Coordinate location of field offices, material sheds and temporary structures with Engineer and Owner.
- D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
- E. Store combustible materials apart from building.

2.3 ENGINEER'S FIELD OFFICE

- A. General: Provide and maintain an Engineer's field office trailer, together with all foundations, steps, landings, handrails, furniture, office equipment, computer equipment, utilities and all other appurtenances required for a complete and functional installation. Provide the Engineer's trailer at the project site for the duration of the construction project. Coordinate the location of the Engineer's trailer with the Owner. Make the completed field office trailer available for occupancy by the Engineer no later than the first day that the Contractor is on-site to begin other construction activities.
- B. Type and Size: Provide a new mobile, tandem-axle field office trailer of not less than 48-feet exterior body length and 12-feet exterior body width.
- C. Arrangement: Arrange trailer's floor plan to provide two offices (one office at each end of the trailer) sized at 11'-0" x 12'-0" and 11'-0" x 10'-0", one washroom (as sewer services will not be available, provide portable washroom as indicated in Section G below), one 4'-0" x 5'-0" storage room and the remainder of the open area in the center of the trailer. Provide a night light over each outside door. Provide privacy locks on the interior door for the washroom and passage locks for all other doors. Provide each window with an operable sash, screen and venetian blinds. Provide an electric furnace with 2-ton air conditioner complete with heating/cooling thermostat. Provide ductwork and regulator type grilles in each room. Provide 100-amp, 120/240-volt electrical service. Provide complete internal connections for single exterior water supply and single exterior sanitary sewer. Provide one bottled water cooler with hot and cold taps and refrigerated storage compartment of approximately one cubic foot capacity. Provide one small refrigerator with freezer. Provide at least ten gallons of bottled water per week. Provide one fully-equipped standard first-aid cabinet. Provide a stock of paper towels and toilet paper throughout the construction period.

- D. Provide a security alarm system that utilizes motion detection to monitor all windows and doors. Provide a battery back-up for the security alarm system.
- E. Have the field office suitably blocked or otherwise installed in accordance with local ordinances. Enclose the air space beneath the trailer with exterior grade plywood panel siding. Provide hinged access doors at utility connection area.
- F. Furnishings: Provide the following:
1. Two 30-inch by 60-inch flattop desks with drawers
 2. Two swivel office chairs
 3. Eight straight-back office chairs
 4. One conference table
 5. Three four-drawer, letter-size, steel filing cabinets with locks and keys
 6. Two plan racks with aluminum plan holders
 7. Four wastebaskets
 8. New, fully equipped standard First Aid cabinet
 9. Underwriters' approved Class ABC chemical fire extinguisher of at least one-quart capacity
 10. All-in-One printer (HP OJ Pro 8500 Wireless Printer, Scanner, Copier or equal)
 - a. Printer
 - 1) Max speeds of 35 pages per minute black, 34 ppm color
 - 2) 1200 x 1200 dpi B/W resolution
 - 3) 4800 x 1200 dpi color resolution
 - 4) Ethernet interface for workgroup printer
 - b. Scanner
 - 1) Resolution up to 4800-dpi optical; maximum scan size 11"x17"
 - c. Copier
 - 1) Duplex printing
 - 2) 1200 x 600 dpi B/W and color resolution
 - 3) Reduce/enlarge 25%-400%
- G. Utility Connections:
1. Connect the water and sanitary sewer to existing lines. If there are no available sanitary sewers:
 - a. Provide and maintain, throughout the duration of the construction project, portable commodes next to the field office trailer.
 - b. Install Sanitary Holding Tank at project inception and connect the trailer sanitary sewer to the Holding Tank. Pump out tank on not less than a weekly basis.
 - c. Provide a suitable water meter installation in accordance with local ordinances. Pay each monthly water bill cost.
 - d. Arrange for the local power company to provide separate, complete and metered electrical service to the field office. Provide a suitable meter installation as approved. Connect the electrical service to the trailer to provide a complete operating installation.

- e. Arrange with the local internet service Contractor to provide either DSL or cable modem service to the field office. Pay each monthly internet connection charge.
- H. Final Ownership: At the completion of construction, the printer equipment will become the property of the Owner. The trailer and all other furnishings shall remain the property of the Contractor.
- I. Trailer Removal: Subsequent to final completion, remove trailer from the project site and transport the trailer off-site. Remove all trailer foundations, anchors, supports, and utility connections. Restore site to its original condition or better.

2.4 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
- C. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
- D. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
- B. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

- B. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."
- C. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
- B. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- H. Install electric power service as noted on the Drawings.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- J. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.4 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 2. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove after the Substantial Completion walkthrough has been performed. Maintain only the temporary facilities required to achieve Final Completion. Contractor's personnel are not permitted to use the permanent facilities.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 25 00 "Erosion and Sedimentation Controls."
 3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 12 16 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 3. Provide temporary, directional signs for construction personnel and visitors.
 4. Maintain and touch up signs so they are legible at all times.
- H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
- J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- C. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- D. Comply with work restrictions specified in Section 01 10 00 "Summary."
- E. Temporary Erosion and Sedimentation Control: Comply with requirements of the IDEM Construction Stormwater General Permit and the Drawings.

- F. Storm water control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.
- G. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
- I. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- J. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- K. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- L. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- M. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
- N. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

3.6 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
- B. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 2. Indicate methods to be used to avoid trapping water in finished work.

- C. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- D. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- E. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 4. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - a. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Engineer.
 - b. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

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

- B. Maintenance: Maintain facilities in good operating condition until removal.
- C. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
- F. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 1. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

(NO TEXT FOR THIS PAGE)

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 42 00 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved by Engineer through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. All product warranties shall commence at the date of Substantial Completion unless specified otherwise in the individual Specification Sections.
- D. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in the General Conditions to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2.2 "OR-EQUAL" PRODUCTS

- A. Conditions for Consideration of Or-Equal Products: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Contractor may return requests without action, except to record noncompliance with these requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements
 2. Evidence that proposed product provides specified warranty.
 3. List of similar installations for completed projects with project names and addresses, and contact information for references, if requested.

4. Samples, if requested.
- B. Submittal Requirements: Approval by the Engineer of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

(NO TEXT FOR THIS PAGE)

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for limits on use of Project site.
 - 2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
 - 3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the Work.

1.3 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.4 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - 1. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- D. Certified Surveys: Submit two copies signed by land surveyor.
- E. Final Property Survey: Submit two copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
 - 1. Provide an experienced survey crew including an instrument operator, competent assistants, and any instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of work performed by the Contractor.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.
- 1.7 DATUM PLANE
- A. All elevations indicated or specified refer to the NGVD 88, , US Foot and are expressed in feet and decimal parts thereof, or in feet and inches.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer in accordance with the General Conditions.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish limits on use of Project site.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Control Points: Base horizontal and vertical control points are established in the Drawings and are to be used as the datum for the Work.
- D. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- E. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- F. Protection: Safeguard all points, stakes, grade marks, known property corners, monuments, and benchmarks made or established for the Work. Re-establish them if disturbed, and bear the entire expense of checking re-established marks and rectifying work improperly installed.
- G. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 FIELD ENGINEERING

- A. Identification: Existing benchmarks, control points, and property corners are shown on the Drawings.

- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points. Report lost or destroyed permanent benchmarks or control points promptly.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.

- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

- a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
 - B. Site: Maintain Project site free of waste materials and debris.
 - C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
 - D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
 - E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
 - F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
 - G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."
 - H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
 - I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
 - J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.8 STARTING AND ADJUSTING
- 3.9 Coordinate startup and adjusting of equipment and operating components with

requirements in Section 01 79 00 "Demonstration and Training."

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

(NO TEXT FOR THIS PAGE)

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 2. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of one week prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance and material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Engineer's signature for receipt of submittals.
 - 5. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures prior to Substantial Completion: Complete the following a minimum of one week prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 8. Complete final cleaning requirements.
 9. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of seven days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of one week prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order..
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file or PDF electronic file. Engineer will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1.10 COMMISSIONING BINDER

- A. Upon completion of training for each equipment item, and prior to Final Completion, provide one (1) commissioning binder. Identify each section based on the equipment using heavy sections dividers with reinforced holes and numbered plastic index tabs. Use 3-ring, slant ring, hard-back binders, Type No. AVE-VS11 as manufactured by Avery Company, or equal. Binder size shall be 3-inch maximum. Punch all loose data for binding. Arrange composition and printing so that punching does not obliterate any data.
- B. At a minimum for each section, i.e. equipment item, provide the following:
 - 1. Certificate of Installation, Inspection and Start-up Services
 - 2. Equipment Data Summary
 - 3. Equipment Preventative Maintenance Summary
 - 4. Manufacturer's Operating and Maintenance Instructions
 - 5. Certificate of Instructional Services
 - 6. Manufacturer's Start-up and Installation Checklists
 - 7. Warranty

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected of a typical municipal water treatment building. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

- a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."
- 3.2 REPAIR OF THE WORK
- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters to comply with requirements for new fixtures.

END OF SECTION 01 77 00

(NO TEXT FOR THIS PAGE)

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 01 79 00 "Demonstration and Training" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer and Owner will comment on whether content of operation and maintenance submittals is acceptable.
 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
- C. Initial Manual Submittal: Submit draft copy of each manual at 50% project completion in electronic PDF format. Do not submit O&M Manuals prior to shop drawing approval. Engineer will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training in electronic PDF format. Engineer will return copy with comments.
1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 10 days prior to commencing demonstration and training. Provide one digital copy, in PDF Format, and three hard copies of each manual.
- E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title, Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
3. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold, and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.

4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Engineer.
 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.
- 1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL
- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- 1.8 EMERGENCY MANUALS
- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
- OPERATION AND
MAINTENANCE DATA

1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Special operating instructions and procedures.
- 1.9 SYSTEMS AND EQUIPMENT OPERATION AND MAINTENANCE MANUALS
- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, routine and special operating procedures, manufacturers' maintenance documentation, preventative maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name, and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Content: In addition to requirements in this Section, include operation and maintenance data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
 11. Manufacturers' Maintenance Documentation
- D. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- E. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- F. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- G. Piped Systems: Diagram piping as installed and identify color coding where required for identification.
- H. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions, bulletins, and procedures; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Maintenance and service schedules.
 3. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 4. Identification and nomenclature of parts and components.
 5. List of items recommended to be stocked as spare parts.
 6. Warranties and Bonds
- I. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- J. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- K. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- L. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.
- M. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name, and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 1. Inspection procedures.

2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

TOWN OF WHEATLAND, INDIANA

WHEATLAND WASTEWATERSYSTEM IMPROVEMENTS DIVISION I - WASTEWATER TREATMENT
PLANT AND REGIONAL LIFT STATION

Equipment Data Summary

Equipment Tag:

Specification Reference:

Manufacturer:

Name:

Address:

Telephone:

Number Supplied:

Location/Service:

Model No:

Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative:

Name:

Address:

Telephone:

NOTES:

TOWN OF WHEATLAND, INDIANA

WHEATLAND WASTEWATERSYSTEM IMPROVEMENTS DIVISION I - WASTEWATER TREATMENT
PLANT AND REGIONAL LIFT STATION

Preventive Maintenance Summary

Equipment Tag:

Location:

Model No:

Serial No:

Maintenance Task	Lubricant/Part	D W M Q SA A	O&M Manual Reference

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

(NO TEXT ON THIS PAGE)

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for final property survey
 - 2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
 - 2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit one paper-copy set of marked-up record prints
 - 2) Submit PDF electronic files of scanned record prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.

- B. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit number of copies of each submittal as defined in the various Specification Sections.

1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Work Change Directive.
 - k. Changes made following Engineer's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Engineer.
 - e. Name of Contractor.

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders and record Drawings where applicable.

1.6 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment
 - 2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: Submit for approval, credentials of equipment manufacturer representatives who are to be course instructors at least 15 days prior to the training sessions.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit one copy within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 - 3. At completion of training, compile transcripts and submit complete training manual(s) for Owner's use prepared in both hard copy and electronic format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Engineer.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.

- b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:

- a. Diagnosis instructions.
- b. Repair instructions.
- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner, through Owner's operations staff with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner unless instructed otherwise. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
1. At beginning of each training module, record each chart containing learning objective and lesson outline.
 2. Perform hands-on training with operations staff to facilitate understanding of operation and maintenance activities. Hands-on training does not need to be recorded.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.
1. Submit video recordings on a USB thumb drive and upload a copy to the project ShareFile/FTP website.
 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.

- c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming, and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Transcript: Provide a transcript of the instruction module. Display images and running time captured from videotape opposite the corresponding training segment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

3.1 TRAINING SESSIONS

- A. Conduct all training during regular hours on weekdays and coordinate the scheduling of all training with the Owner.
- B. Perform training utilizing actual equipment in service. Use of equipment for training will not void manufacturers' or contract warranties.
- C. Provide training for the following:

<u>Specification Section</u>	<u>Equipment Name</u>	<u>Minimum Training Hours</u>
26 24 16	Panelboards	8
26 28 26	Transfer Switches	4
26 29 23	Variable Frequency Drives	4
26 28 26	Transfer Switches	4
26 32 13	Engine Generators	4
33 32 19	Public Utility Wastewater Pumping Stations	8
46 31 00	UV Disinfection Equipment	8
46 51 00	Wastewater Treatment Package Plant	50

END OF SECTION 01 79 00

CERTIFICATE OF INSTRUCTIONAL SERVICES

Project: _____

Equipment: _____

Specification Section: _____

I hereby certify the equipment Manufacturers' Representative has instructed Owner's personnel in startup operation and maintenance of this equipment as required in the Contract Documents.

Manufacturer's Representative

Signature _____

Name: (print) _____

Title: _____

Representing _____

Contractor

Signature _____ Date _____

Name (print) _____

Title _____

Owner

Signature _____ Date _____

Name (print) _____

Title _____

Comments:

Complete and submit this form to Engineer upon completion of training as required by Specification Section 01 79 00.

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected site elements.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01 10 00 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01 50 00 "Temporary Facilities and Controls" for the preconstruction video.
3. Section 01 73 00 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 REFERENCES

- A. Codes and standards referred to in this Section are:

1. ANSI/ASSE A10.6 - Safety & Health Program Requirements for Demolition Operations
2. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.5 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.6 INFORMATIONAL SUBMITTALS

- A. Demolition Plan
 1. Include Proposed Protection Measures: Submit plan that indicates the measures proposed for protecting individuals, property, and adjacent buildings, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
 2. Plan should provide the most expeditious dismantling of the structure safely feasible to minimize the duration of time partially standing structures remain.
- B. Preconstruction/Predemolition Photographs or Video: Submit before Work begins.
- C. Contractor shall provide thorough and complete written documentation of the demolition of the elevated tank. The documentation shall include a description of the material, date of removal, and date of delivery to the receiving facility if requested. The documentation shall include the written verification of the receiving facility.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes if required.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is expected that lead paint will be encountered in the Work, specifically in the existing elevated storage tank. Follow 29 CFR 1910.1025(a)(2) for protection during demolition.
 - 1. If other suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. They will be removed by Owner under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

3.2 DAMAGE SURVEY.

- A. Requirements: Conduct a damage survey of the Work site and adjacent properties prior to commencing the Work and before making application for final payment for the Work. Owner shall be present during the videotaping. Provide Owner with two copies of the videotaping on USB drives. Record all planned construction areas, material storage areas, areas adjacent to these areas, including but not limited to, farmland, streets, driveways, sidewalks, curbs, ditches, fencing, railing, visible utilities, retaining structures, landscaping and trees, and adjacent building structures. The purpose of the video is to document existing site conditions and to provide a fair measure of required restoration. Care should be taken to record all existing conditions which exhibit deterioration, imperfections, structural failures, or situations that would be considered substandard. The video image shall be of sufficient detail to delineate important features and conditions of the project area including public right-of-way and adjacent private property.
- B. No recording shall be performed during periods of precipitation, mist, fog or when the ground is covered in snow. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording. The audio portion of the recording shall reproduce precise and concise explanatory notes by the camera operator with proper volume, clarity and freedom from distortion.
- C. At the start of production and at the beginning of a new street, building or basement, an identification summary shall be read into the recording while using a wide-angle view of the video to display numeric displays for visual record. This summary shall include: 1) tape number; 2) project name; 3) job location; 4) positional location at start of job; 5) date and time; 6) weather; 7) direction of camera; 8) any other notable conditions.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 01 10 00 "Summary."

- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3.4 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Comply with requirements for access and protection specified in Section 01 50 00 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches.
 4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials.
 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 6. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area as designated by Owner.
 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them at the expense of the Contractor. The Contractor shall bear full responsibility for any and all fines against the project resulting from improper handling and disposal of the waste materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

(NO TEXT FOR THIS PAGE)

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Provide concrete formwork for architectural concrete and structural concrete as specified to form concrete to profiles shown.
 - 1. Structural concrete is defined as all concrete that is not architectural concrete.
- B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:
 - 1. Section 03 20 00 - Concrete Reinforcement
 - 2. Section 03 15 00 - Concrete Accessories
 - 3. Section 03 31 00 - Cast-In-Place Concrete

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ACI 318 - Building Code Requirements for Reinforced Concrete
 - 2. ACI SP-4 - Formwork for Concrete
 - 3. ACI 303R - Guide to Cast-in-Place Architectural Concrete

1.3 QUALITY ASSURANCE

- A. Formwork Compliance: Use formwork complying with ACI SP-4 and ACI 303R.
- B. Mock-Up Erection: Erect, on the site where directed, a full size mock-up of a cast-in-place wall or panel a minimum of 10 feet by 10 feet by 12 inches thick as shown. Conform mock-up to requirements of ACI 303R.
 - 1. Reinforce the panel as shown. Use form ties the same as those approved and with the form tie pattern similar to that approved. Use one face of the panel for smooth architectural concrete including “reveal” rustication with form joints, and the opposite face for form liner concrete.

2. Plug the tie holes as specified to determine the correct mortar mixture to match the panel color. If required, remove and replace tie hole plugging mortar until an acceptable color match is obtained. After the sample panels have been approved, intentionally damage and patch portions of the finish surface of the panels for the purpose of determining the correct mixture for patching mortar and patching technique to match the original panel color and surface.
3. Leave the approved mock-up on the job during construction as the standard of workmanship for the project. Remove mock-up from the premises after completion of the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.
 1. Release Agent
Magic Kote VOC by Symons Corporation
 2. Form coating
A.C. Horn Corporation, Brooklyn, NY
 3. Form liners
Dura-Tex by Symons Corporation, Des Plaines, IL
 4. Rustications
Symons Corporation, Des Plaines, IL

2.2 MATERIALS

- A. Structural Concrete: Provide structural concrete form materials as follows:
 1. Obtain approval for form material before construction of the forms.
 2. Use a barrier type form release agent.
 3. Use form ties, hangers, and clamps of such type that, after removal of the forms, no metal will be closer than one inch from concrete surface. Wire ties will not be permitted.
 4. Provide ties with swaged washers or other suitable devices to prevent seepage of moisture along the ties. Leave the ties in place.

5. Use lugs, cones, washers, or other devices which do not leave holes or depressions greater than 7/8-inch in diameter.
- B. Architectural Concrete: Provide architectural concrete form materials as follows:
1. Construct forms using 3/4-inch thick, High Density Overlay (HDO) Plyform, Class 1 or 2, meeting the requirements of the American Plywood Association. Use surfacing materials having a minimum weight of 60-60.
 2. Use form coating, and use thinner as recommended by manufacturer of the form coating, to coat cut or raw edges.
 3. Use she-bolts with water seals for form ties.
 4. Use form liners having one inch deep relief, elastomeric Dura-Tex in a fractured rib pattern to match existing. Furnish form liners in full height lengths with no horizontal joints, except where shown. Use wood for forms to be used with form liners.
 5. Use elastomeric vertical “V-groove” rustications in the concrete bands and the horizontal rustication joints shown in the form liner concrete of the profile shown.
 6. Use a barrier type VOC compliant form release agent.

PART 3 EXECUTION

3.1 DESIGN

- A. Design Responsibility: Be responsible for the design, engineering and construction of the architectural concrete formwork and the structural concrete formwork. Conform the work to the recommendations of ACI SP-4 and ACI 303R.
- B. Setting Time and Slag Use: The presence of fly ash or ground granulated blast furnace slag in the concrete mix for architectural concrete and structural concrete will delay the setting time. Take this into consideration in the design and removal of the forms.
- C. Responsibility During Placement: Assume and take sole responsibility for adequate design of all form elements for support of the wet concrete mixtures specified and delivered.

- D. Consistency: Design forms to produce concrete members identical in shape, lines and dimensions to members shown.

3.2 CONSTRUCTION DETAILS FOR FORMWORK

- A. Structural Concrete Details: Follow the following details for all structural concrete:

1. Provide forms which are substantial, properly braced, and tied together to maintain position and shape and to resist all pressures to which they may be subjected. Make forms sufficiently tight to prevent leakage of concrete.
2. Determine the size and spacing of studs and wales by the nature of the work and the height to which concrete is placed. Make forms adequate to produce true, smooth surfaces with not more than 1/8-inch variation in either direction from a geometrical plane. Provide horizontal joints which are level, and vertical joints which are plumb.
3. Supply forms for repeated use in sufficient number to ensure the required rate of progress.
4. Thoroughly clean all forms before reuse and inspect forms immediately before concrete is placed. Remove deformed, broken, or defective forms from the work.
5. Provide temporary openings in forms at convenient locations to facilitate cleaning and inspection.
6. Coat the entire inside surfaces of forms with a suitable form release agent just prior to placing concrete. Form release agent is not permitted on the reinforcing steel.
7. Assume and take responsibility for the adequacy of all forms and remedying any defects resulting from their use.

- B. Architectural Concrete Details: Follow the following details for all Architectural Concrete:

1. Conform all construction details for formwork to “Construction Details for Formwork,” subsections A1, A2, A3, A4, A6 and A7 and the requirements of this section.
2. Thoroughly clean and lightly recoat HDO plywood panels before each additional use. Do not use forms more than three times.

3. Install form liners and rustication strips in strict accordance with the manufacturer's written instructions and recommendations. Clog the ends of the form liner pattern and tape all form joints and edges using 1/8-inch thick by 3/4-inch wide foam tape centered on the joints, then caulk in accordance with the manufacturer's recommendations each time forms are set. Have a representative of the manufacturer present at the site to supervise the installation of the form liner for the entire project.
4. Install forms for smooth concrete in such a manner that there will be no horizontal form joints, and align the forms so that vertical joints occur only at "V-Groove" rustications. Space form ties in a uniform pattern vertically and horizontally. Position form ties in smooth concrete bands and in panels between "reveal" rustications, if any.
5. Erect beam and girder soffits with a camber of 1/2-inch in 20 feet and sufficiently braced, shored, and wedged to prevent deflection. Clamp column sides in accordance with this specification with metal column clamps, spaced according to the manufacturer's directions.
6. Provide external angles of walls, beams, pilasters, columns, window openings and girders with 3/4-inch bevel strips.
7. Give surfaces of concrete panel forms one thinned coat of form film.
8. Apply the release agent in strict accordance with the manufacturer's instructions.

3.3 FORM REMOVAL

- A. General: Do not remove forms, form ties and bracing for structural and architectural concrete without specific permission of the CONTRACTOR's Registered Professional Engineer.
- B. Structural Concrete Form Removal: Do not remove forms for structural concrete until the concrete has hardened sufficiently to support its own load safely, plus any superimposed load that might be placed thereon. Leave the forms in place for the minimum length of time indicated below or until the concrete has reached the minimum strength indicated as determined by testing, whichever time is reached first.
 1. The times indicated represent cumulative days or hours, not necessarily consecutive, during which the air surrounding the concrete is above 50 degrees F. These times may be decreased if reshores are installed.

	Minimum Time	Minimum Strength (psi)
a. Columns	12 hrs.	1300
b. Columns	12 hrs.	1300
c. Side forms for girders and beams	12 hrs.	1300
d. Walls	12 hrs.	1300
e. Bottom forms of slabs		
Under 10 feet clear span	4 days	2300
10 to 20 feet clear span	7 days	2700
Over 20 feet clear span	10 days	2900
f. Bottom forms of beams and girders		
Under 10 feet clear span	7 days	2700
10 to 20 feet clear span	14 days	3000
Over 20 feet clear span	21 days	3500
2. Increase form removal times as required if concrete temperature following placement is permitted to drop below 50 degrees F or if fly ash or ground granulated blast furnace slag is used in the concrete mix.		
3. Withdraw the removable portion of form ties from the concrete immediately after the forms are removed. Clean and fill holes left by such ties with grout as specified in Cast-In-Place Concrete, Subsection Structural Concrete Surfaces.		
4. Plug tie holes flush with the surface using portland cement mortar. Prewet tie holes with clean water and apply a neat cement slurry bond coat. Densely tamp mortar of a dry-tamp consistency into the tie holes exercising care so as not to smear mortar onto the finished concrete surface. Include sufficient white cement in the mortar mix to cause the plugged holes to blend in with the adjacent surfaces. Make sample patches with different mixes to assure that this requirement is met.		
C. Architectural Concrete Form Removal: Remove forms for architectural concrete in accordance with the above subsection 3.03 A and B, except that do not remove forms for vertical surfaces sooner than 12 hours nor longer than 36 hours after placement of concrete.		

3.4 RESHORING

- A. Reshoring Method: Develop a system for reshoring and early removal of forms, in the event early stripping of forms becomes necessary. Include details and schedules in this system for each element which is to be reshored.
- B. Construction Load Support: Do not support construction loads upon any unshored portion of the structure exceeding the structural design loads.

3.5 TOLERANCES

- A. Tolerance Limits: Design, construct and maintain concrete form and place the concrete to provide completed concrete work within the tolerance limits set forth in ACI SP-4.

3.6 SURVEY OF FORMWORK

- A. Field Survey: Employ an engineer or surveyor to check by instrument survey the lines and levels of the completed formwork before concrete is placed and make whatever corrections or adjustment to the formwork are necessary to correct deviations from the specified tolerances.
- B. Placement Surveying Requirements: Check formwork during the placement of the concrete to verify that the forms, braces, tie rods, clamps anchor bolts, conduits, piping, and the like, have not been knocked out of the established line, level or cross section by concrete placement or equipment.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03 15 00

CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for providing concrete accessories shown and specified herein such as waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.
- B. Products Installed: Waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.
- C. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:
 - 1. Section 03 10 00 - Concrete Formwork
 - 2. Section 03 20 00 - Concrete Reinforcement
 - 3. Section 03 31 00 - Cast-in-Place Concrete

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. AASHTO - Standard Specifications for Highway Bridges
 - 2. ASTM A 240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
 - 3. ASTM A 536 - Standard Specifications for Ductile-Iron Castings
 - 4. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
 - 5. ASTM D 3545 - Test Methods for Alcohol Content and Purity of Acetate esters by Gas Chromatography
 - 6. ASTM D 3575 - Test Methods for Flexible Cellular Materials Made From Olefin Polymers

7. CRD-C513 - Specifications for Rubber Waterstops
8. CRD-C572 - Specifications for Polyvinyl Chloride Waterstop
9. Fed. Spec.
TT-S-00227 - Sealing Compound, Elastomeric Type, Multicomponent (for Calking, Sealing, and Glazing in Buildings and Other Structures)
10. Fed. Spec.
TT-S-00230 - Sealing Compound, Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)

1.3 SUBMITTALS

- A. General: Provide all Work related submittals, including the following, as specified in Division 1.
- B. Product Data and Information:
 1. Manufacturer's Data and Specifications: Submit printed manufacturer's data and specifications for each item used on this project.
 2. Samples: Provide one sample of each item used.
 3. Joint Sealant and Preformed Joint Seal: Indicate special procedures, surface preparation and perimeter conditions requiring special attention. All products in contact with potable water, shall be "NSF Standard 61" certified. Submit certified material records indicating approval for use with potable water.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all products and materials as specified in Division 1 (and as follows:)

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Joint Filler
 - a. Sonoflex F Foam by Sonneborn Building Products
 - b. PVC Joint Filler No. 327 by A.C. Horn
2. Sealant Backup Material
 - a. Sealtight Backer Rod
 - b. Sonofoam Backer Rod
3. Preformed Joint Seal
 - a. Evazote 380, ESF by Epoxy Industries
4. Wedge Inserts
 - a. Type F-7 by Dayton Superior, Miamisburg, OH
5. Dovetail Anchor
 - a. A.A. Wire Products Co.
 - b. Dur-O-Wal Inc.
6. Flashing Reglets
 - a. Standard reglets by Beehive Anchoring System

2.2 MATERIALS

- A. Extruded Waterstops: Provide waterstops made of extruded polyvinyl chloride unless otherwise shown or specified.
 1. Do not use any reclaimed plastic material in their manufacture.
 2. Provide plastic waterstops meeting the requirements of CRD-C572, except as modified herein. Provide a Shore A/10 durometer hardness between 73 and 79, the tensile strength not less than 1850 psi, and specific gravity not more than 1.38.
 3. Unless otherwise shown, use waterstops for construction joints which are flat, at least 6 inches wide, and not less than 3/8-inch thick at the thinnest section. Provide these waterstops with ribbed longitudinal strips.

4. Unless otherwise shown, provide waterstops for expansion joints at least 9 inches wide and not less than 1/4-inch thick at the narrowest point and not less than 3/8-inch thick immediately adjacent to the center of the waterstop. Provide the waterstop with ribbed longitudinal strips with a 3/4-inch inside diameter hollow bulb center. Limit joint movement to 1/4-inch under a tensile force of not more than 500 pounds per lineal inch.
- B. Stainless Steel Waterstops: Provide stainless steel waterstops where shown or specified.
1. Fabricate stainless steel waterstops from ASTM A 240 Type 316, 20 gauge stainless steel, conforming to the dimensions and profiles shown.
 2. Prefabricate and miter corners and intersections for all stainless steel waterstops. Make only butt joints in the field.
- C. Rubber Waterstops: Provide rubber water stops where shown or specified.
1. Provide rubber water stops of either the molded or extruded type, fabricated from a high grade tread type compound, either SBR or natural rubber, conforming to CRD-C513.
 2. Provide water stops for construction joints at least 6 inches wide and 3/8-inch thick and with solid end bulbs 3/4-inch in diameter.
 3. Provide water stops for expansion joints 9 inches wide and 3/8-inch thick and with solid end bulbs 1-inch in diameter and a hollow center bulb 1-1/2 inches in diameter with a 3/4-inch diameter center cavity.
- D. Expansion Joint Filler: Use joint filler for all expansion joints.
1. Provide a closed cell polyethylene or PVC joint filler of the thickness shown.
- E. Joint Sealant Requirements: Finish expansion joints with a joint sealant where shown or specified.
1. Joint sealant materials may be either a single component urethane compound meeting the requirements of Fed. Spec. TT-S-00230C, or a 2-component urethane compound meeting the requirements of Fed. Spec. TT-S-00227E, except as modified in this specification.

2. Provide the urethane sealant of 100 percent polymer, non-extended, containing no solvent, lime, or coal tar. Color as selected by the ENGINEER, but not black. Conform sealant properties to the following:

	Property	Value	Test Method
a.	Maximum final cure	3 days	--
b.	Minimum tensile strength	140 to 200 psi	ASTM D 412
c.	Minimum elongation	400%	ASTM D 412
d.	Modulus at 100% elongation	40-60 psi	ASTM D 412
e.	Shore A hardness	25-40	ASTM D 2240
f.	Solid content	98-100%	--
g.	Peel strength	20-40 lb/in.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E
h.	Minimum recovery	80-90%	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E
i.	Initial tack-free cure	24-48 hrs.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E

3. Provide primer as recommended by the manufacturer of the sealant, subject to approval.
4. Provide fillers and backup materials in contact with sealant which are nonimpregnated and free from asphalt, creosote, oil or extractable plasticizers. Use a backup material of a closed cell polyethylene foam rod with a diameter 1/4-inch larger than the joint width.

F. Preformed Joint Seal: Provide a preformed joint seal where shown or specified.

1. Provide joint material which is resilient, non-extrudable, impermeable, closed-cell, cross-linked, ethylene vinyl acetate, low density, polyethylene copolymer, nitrogen blown material which is ultraviolet light, weather and wear resistant, and which is concrete beige in color.

2. Conform material properties with the following:

	Property	Value	Test Method
a.	Density, pcf	2.8 to 3.4	ASTM D 3575 Suffix: W, Method A

- | | | | |
|----|---|-----------------|-----------------------|
| b. | Water Absorption total immersion 3 months | 0.02% by volume | ASTM D 3575 Suffix: L |
| c. | Tensile Strength | 125 psi | ASTM D 3575 Suffix: T |
| d. | Elongation before breaking | 255% | ASTM D 3575 Suffix: T |
| e. | Working Temperature | -94 to 160 F | -- |
- G. Neoprene Pads: Use neoprene pads as shown or required where slabs or beams must be prevented from bonding to footings, walls, columns or other rigid parts of the structure.
1. Use neoprene pads of a structural grade meeting the requirements of Section 25, Division 2 of the AASHTO Standard Specifications for Highway Bridges.
 2. Do not use neoprene pads thinner than 1/4-inch.
- H. Wedge Inserts: Make wedge inserts for 5/8-inch and 3/4-inch bolts of ductile iron conforming to ASTM A 536.
- I. Dovetail Anchors: Provide dovetail anchors of one of the following types:
1. Dovetail anchors having a 3/16-inch by 1-inch by 1/2-inch stainless steel dovetail section with 3/16-inch diameter stainless steel wire.
 2. Dovetail anchor slots of 24 gauge galvanized steel 1-inch by 1-inch by 5/8-inch throat. Fill anchor slots.
- J. Flashing Reglets: Provide flashing reglets of 24 gauge galvanized steel foam filled reglets.

PART 3 EXECUTION

3.1 INSTALLING OF WATERSTOPS

- A. Assembly of Extruded Waterstops: Prefabricate corners and intersections for all waterstops. Make only butt joints in the field. Miter and assemble corners and intersections with approved equipment, as described for field joints.
1. Make field joints by cutting the ends of the sections to be spliced so they will form a smooth even butt joint. Heat the cut ends with the splicing tool until the plastic melts. Press the two ends together until the plastic cools. Do splicing in a way that limits damage to the continuity of the ribbed strips.

2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.
- B. Prefabricated Stainless Steel Waterstops: Prefabricate corners and intersections for all stainless steel waterstops. Make only butt joints in the field. Miter and weld corners and intersections.
1. Provide field joints having a nominal 1-inch lap joint, with the exposed edge welded or brazed on each side.
 2. Make field joints with PVC waterstops as shown.
 3. At expansion joints, seal the base of the expansion section of the waterstop with at least one layer of 2-inch wide duct tape.
 4. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.
- C. Splices: Use splices made in the manufacturer's plant where possible for rubber waterstops.
1. Use a preformed rubber union or fitting and splicing cement as recommended by the manufacturer when splices are made.
 2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.
- D. Joint Filler Placement: Place joint filler for expansion joints against the completed portion of the work before the concrete for the next section is placed.

1. Fasten the filler to the hardened concrete with a compatible adhesive in accordance with manufacturer's instructions. Extend the filler through the thickness of the wall or slab and make it flush with the finished surface, except where a preformed joint seal or joint sealant is shown.
 2. In joints having a waterstop, fit the filler accurately on each side of the waterstop to prevent the intrusion of concrete.
- E. Preparation of 2-Component Sealants: Mix 2-component joint sealant using a slotted paddle and slow speed mixer for 5 to 8 minutes, continually working paddle from top to bottom until the sealant color is uniform. Scrape down the side of the container and paddle blade several times during the mixing operation to ensure uniform mixing.
1. Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are structurally sound, clean, dry, and free of all oil, grease, wax, waterproofing compounds or form release materials prior to the application of primer and sealant.
 2. Prime all concrete joint surfaces and all surfaces exposed to water prior to sealing, with no exceptions. Prime all other surfaces as recommended by the manufacturer of the sealant. Provide the prime as recommended by the manufacturer of the sealant, subject to approval. Apply the primer by either brushing or spraying on the joint surfaces. Apply and install the sealant within 2 to 24 hours after the application of primer.
 3. For horizontal joints, install the sealant by pouring directly from a suitable shaped can or by flowing from a bulk-loading gun.
 4. Fill vertical joints from a gun, starting from the bottom, to avoid bridging and the formation of air voids.
 5. Fill overhead joints from a gun, by laying a bead along each side of the joint and then filling the middle. Immediately after installation, tool in the sealant in order to establish firm contact with joint surfaces and to provide a smooth sealant surface. Tool in accordance with the manufacturer's instructions.
 6. Control joint depth with the use of joint fillers and backup materials. Make joint widths and sealant depths as shown. Do not exceed 1/2-inch for sealant depth.
- F. Preformed Joint Seal Surface Preparation: Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are

structurally sound, clean, dry, and free of all oil, grease, wax, water-proofing compounds or form release materials.

1. Blast clean or saw cut all existing concrete surfaces to expose a clean bare concrete surface. Allow new concrete to be well cured, and attain a minimum of 80 percent of the specified strength before installing sealant.
 2. Apply bonding adhesive, as recommended by the manufacturer to the concrete surfaces in strict compliance with the manufacturer's recommendations. Install the joint material under a compression of 25 percent and in one continuous operation, in accordance with manufacturer's recommendations. Do all splices and directional changes using heat welding method as recommended by the manufacturer.
- G. Unbonded Joints: Use unbonded horizontal joints as shown or required where slabs of beams must be prevented from bonding to footings, walls, columns or other rigid parts of the structure.
1. Prevent bonding by use of structural grade neoprene pads placed over the bearing surface of the footing, wall or other supporting part of the structure so as to isolate it from the new concrete being placed.
- H. Encasing Inserts: Encase wedge inserts, flashing reglets and dovetail anchor slots in the concrete as shown. Take special care to place and maintain them to the proper lines and grades and to compact concrete thoroughly around them to prevent the passage of water. Set these items before placing concrete and thoroughly brace them to prevent movement during the progress of the work. Provide dovetail anchor slots spaced not more than 16 inches apart for all concrete walls faced with masonry.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for providing concrete reinforcement as shown and specified herein. Reinforcement includes all steel bars, wire and welded wire fabric as shown and specified.
- B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:
 - 1. Section 03 10 00 - Concrete Formwork
 - 2. Section 03 31 00 - Cast-In-Place Concrete

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ACI SP66 - ACI Detailing Manual
 - 2. ACI 318 - Latest edition "Building Code Requirements for Reinforced Concrete"
 - 3. ASTM A 185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - 4. ASTM A 615/A615M - Deformed and Plains Billet-Steel Bars for Concrete
 - 5. ASTM A 706/A706M - Low Alloy Steel Deformed Bars for Concrete Reinforcement
 - 6. ASTM A 775/A775M - Epoxy Coated Reinforcing Steel Bars
 - 7. AWS D1.4 - Structural Welding Code - Reinforcing Steel

1.3 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.

1. Product Data and Information: Submit manufacturers literature with product data, and material description of fusion bonded epoxy coating for reinforcement and reinforcement accessories, including manufacturer's recommendations for field touch-up of bars and cut ends.
2. CONTRACTORS' Shop Drawings: Submit checked Working Drawings, including bar lists, schedules, bending details, placing details and placing plans and elevations for fabrication and placing reinforcing steel conforming to "ACI Detailing Manual - 88".
 - a. Do not bill wall and slab reinforcing in sections. Show complete elevations of all walls and complete plans of all slabs, except that, when more than one wall or slab are identical, only one such elevation or plan is required. These plans and elevations need not be true views of the walls or slabs shown. Bill every reinforcing bar in a slab on a plan. Bill every reinforcing bar in a wall on an elevation. Take sections to clarify the arrangement of the steel reinforcement. Identify all bars, but do not bill on such sections.
 - b. For all reinforcing bars, unless the location of a bar is clear, give the location of such bar or bars by a dimension to some structural feature which will be readily distinguishable at the time bars are placed.
 - c. Make the reinforcing steel placing drawings complete for placing reinforcement including the location of support bars and chairs, without reference to the design drawings.
 - d. Submit Detailer certification that every reinforcing steel placing drawing and bar list is completely checked and corrected before submittal for approval.
 - e. If, after reinforcing steel placing drawings and bar lists have been submitted for approval, a review reveals that the drawings and lists obviously have not been checked and corrected they will be returned for checking and correcting by the Detailer.
3. Samples: Submit the following samples when epoxy coated reinforcement is specified to be used.
 - a. 12-inch long epoxy-coated steel reinforcing bar, of any size typical to this Project

- b. One of each type of epoxy-coated reinforcement accessory used on this Project
 - c. 12-inch long, nylon coated tie wire
4. Certificates: Test certificates of the chemical and physical properties covering each shipment of reinforcing steel bars.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all products and materials as specified in Division 1 (and as follows:)
- 1. Delivery Requirements: Have reinforcing steel delivered to the work in strongly tied bundles. Identify each group of both bent and straight bars with a metal tag giving the identifying number corresponding to the reinforcing steel placing drawings and bar lists.
 - 2. Storage: Properly store all bars in an orderly manner, with all bars completely off the ground. Keep bars clean after delivery to the site of the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.
- 1. Mechanical connections
 - a. Dowel Bar Splicer/Dowel-In System and Coupler Splice System of the Richmond Screw Anchor System
 - b. Cadweld Rebar Splice by Erico Products Inc.
 - c. Bar Grip Splice by Barsplice Products Inc.

2.2 MATERIALS

- A. Steel Bars: Use new billet steel bars, deformed bars, meeting the requirements of ASTM A 615/A625M Grade 60 for reinforcing steel bars.

1. Roll all reinforcing steel bars with special deformations or identifying marks indicating the ASTM Specification and Grade.
 2. Use bars free from defects, kinks and from bends that cannot be readily and fully straightened in the field.
 3. Supply reinforcing bars in lengths which will allow convenient placement in the work and provide the required lap of joints as shown. Provide dowels of proper length, size and shape for tying walls, beams, floors, and the like together.
- B. Epoxy Coating: Conform fusion bonded epoxy coated reinforcing steel bars to ASTM A 775/A775M when used. Leave portions of the reinforcing steel bars uncoated where mechanical connections are shown.
- C. Welded Wire Fabric: Use welded wire fabric of the electrically welded type, with wires arranged in rectangular patterns, of the sizes shown or specified and meeting the requirements of ASTM A 185.
- D. Supports and Accessories: Provide bar supports and other accessories and, if necessary, additional supports to hold bars in proper position while concrete is being placed.
1. Use side form spacers against vertical or sloping forms to maintain prescribed side cover and cross position of bars.
 2. Use individual hi-chairs with welded cross ties or circular hoops to support top bars in slabs thicker than 8 inches.
 3. Bolsters, chairs and other accessories:
 - a. Use hot-dipped galvanized or provide plastic coated legs when in contact with forms for surfaces of concrete other than architectural surfaces.
 - b. Use stainless steel when in contact with forms for architecturally exposed surfaces.
 - c. Use epoxy coated bolsters, chairs and accessories including wire ties for epoxy coated reinforcing bars.
 - d. Use chairs of an approved type and space them properly to support and hold reinforcing bars in position in all beams and slabs including slabs placed directly on the subgrade or work mat. Do not use

continuous hi-chairs for supporting of top bars in slabs over 8 inches in thickness.

- E. Mechanical Connections: Provide mechanical connections that develop at least 125 percent of the specified yield strength of the bar in tension.

2.3 FABRICATION

- A. Drawing Review Prior to Fabrication: Do not fabricate any material before final review and approval of shop drawings.
- B. Bending and Cutting: Cut bars to required length and bend accurately before placing. Bend bars in the shop unless written approval for field bending is obtained. If field bending is permitted, do it only when the air temperature, where the bending operation is performed, is above 30 degrees F. Do not field bend bars which have been partially embedded in concrete.
- C. Splices: Use lapped splices for tension and compression splices unless otherwise noted.
- D. Cleaning: Clean and bend reinforcement in accordance with ACI 315 and ACI 318.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Placement: Place all bars in accordance with CRSI "Recommended Practice for Placing Reinforcing Bars".
- B. Tolerances: Place bars used for top reinforcement in slabs to a vertical tolerance of plus or minus 1/4-inch. Place all other reinforcement to the tolerances given to ACI 318.
- C. Cleaning: Have reinforcing steel delivered without rust other than that accumulated during transportation to the work. At all times, fully protect reinforcing steel from moisture, grease, dirt, mortar and concrete. Before being placed in position, thoroughly clean reinforcing steel of all loose mill scale and rust and of any dirt, oil, grease coatings, or other material that might reduce the bond. If there is a delay in depositing concrete, inspect and satisfactorily clean the steel immediately before the concrete is placed.
- D. Bar Positioning: Place bars in the exact positions shown with the required spacing and cross wire bars securely in position at intersections to prevent displacement

during the placing of the concrete. Fasten the bars with annealed wire of not less than 17 gauge or other approved devices.

- E. Bar Extension Beyond Formwork: On any section of the work where horizontal bars extend beyond the length of the forms, perforate the form or head against which the work ends or at the proper places to allow the bars to project through a distance at least equal to the lap specified.
- F. Unacceptable Materials: Do not place reinforcing steel with damaged, unsuitably bonded epoxy-coating or rusting. If approved, mars, exposed threads of mechanical connections and cut ends may be field coated with approved epoxy coating material.
- G. Review of Placement: Have reinforcing placement reviewed by the ENGINEER before concrete is placed.
- H. Welding - Not Approved: Do not use reinforcing bar assemblies made by welding of any kind, or accessories of any kind which require field welding to reinforcing bars.
- I. Welding - Approved: Where welding of reinforcing steel is shown, AWS D1.4 "Structural Welding Code - Reinforcing Steel" applies.
- J. Tension and Compression Lap Splices: Conform tension and compression lap splices to ACI 318 with all supplements. Avoid splices at points of maximum tensile stress wherever possible. Provide temperature bars with the clear spacing shown. Stagger all bar splices in hoop tension bars in circular tanks with not more than 50 percent of the bars spliced in any one direction. Have welded splices made by certified welders in accordance with AWS D1.4.
- K. Welded Wire Fabric: Place welded wire fabric in the positions shown, specified or required to fit the work. Furnish and place suitable spacing chairs or supports, as specified for bars, to maintain the fabric in the correct location. Where a flat surface of fabric is required, provide flat sheets, when available. Otherwise reverse roll the fabric or otherwise straighten to make a perfectly flat surface before placing. Obtain approval for the length of laps not indicated.
- L. Concrete Cover: Place reinforcing steel and welded wire fabric and hold in position so that the concrete cover, as measured from the surface of the bar or wire to the surface of the concrete, is as shown or specified.

END OF SECTION

SECTION 03 30 00

REINFORCED CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Providing reinforced cast-in-place concrete as specified herein to form concrete to profiles as shown on the plans.

1.2 REFERENCES

- A. Comply with the following codes and standards regarding this Section:
1. ACI 212 - Chemical Admixtures for Concrete
 2. ACI 301 - Specifications for Structural Concrete for Buildings
 3. ACI 303R - Guide to Cast-In-Place Architectural Concrete
 4. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
 5. ACI 305R - Hot Weather Concreting
 6. ACI 306R - Cold Weather Concreting
 7. ACI 308 - Practice for Curing Concrete
 8. ACI 309 - Guide to Consolidation of Concrete
 9. ACI 318 - Building Code Requirements for Structural Concrete
 10. ACI 347 - Guide to Formwork for Concrete
 11. ASTM C 31 - Practice for Making and Curing Concrete Test Specimens in the Field
 12. ASTM C 33 - Specifications for Concrete Aggregates
 13. ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens

14. ASTM C 94 - Specifications for Ready Mixed Concrete
15. ASTM C 143 - Test Method for Slump of Hydraulic Cement Concrete
16. ASTM C 150 - Specifications for Portland Cement
17. ASTM C 172 - Practice for Sampling Freshly Mixed Concrete
18. ASTM C 173 - Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method
19. ASTM C 309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete
20. ASTM C 618 - Specification for Coal Fly Ash and Raw Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
21. ASTM A 615/
A615M - Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
22. ASTM C 1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.3 DEFINITIONS

- A. Structural concrete is defined as all concrete that is not architectural concrete.

1.4 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.
 1. Concrete mix designs for each type of concrete.
 2. Air content tests in accordance with ASTM C 138 or C 173 with mix design data.
 3. Concrete slump test results.
 4. Concrete strength test results.

5. Working Drawings for fabrication and placing reinforcing steel conforming to “ACI Detailing Manual - 2004”.

1.5 QUALITY ASSURANCE

- A. Meet the requirements of codes and references identified in Article 1.2 - REFERENCES of this Section.
- B. Demonstrate compliance with concrete slump and compressive strength requirements by submitting test reports prepared by an independent testing agency.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Use formwork complying with ACI SP-4 and ACI 303R.
- B. For architectural concrete, provide 3/4-inch bevel strips at exposed corners of walls, beams, pilasters, columns, window openings and girders.
- C. Provide new deformed bars meeting the requirements of ASTM A615/A615M Grade 60 for concrete reinforcing steel bars and sized and placed as shown.
- D. Use lapped splices for tension and compression, as shown.
- E. Provide concrete meeting the requirements of ACI 318 and the following:
 1. Minimum 28-day compressive strength of 4000 psi,
 2. Use standard Portland cement meeting the requirements of ASTM C 150 Type I or Type II,
 3. If used, fly ash is to meet the requirements of ASTM C 618 Class C or F and not exceed 20 percent by weight of the cement plus fly ash, while maintaining minimum cement content of 450 pounds per cubic yard,
 4. Fine aggregate of natural sharp sand meeting the requirements of ASTM C 33 for normal weight concrete,
 5. Coarse aggregate consisting of crushed stone, processed from natural rock or stones, meeting the requirements of ASTM C 33 for normal weight concrete, Size No. 57,

6. Limit the use of admixtures to the following:
 - a. Air-entraining admixture conforming to ASTM C 260,
 - b. Water-reducing admixture conforming to ASTM C 494 Type A,
 - c. Water reducing set retarders conforming to ASTM C 494 Type D,
 - d. Do not use admixtures containing calcium chloride, thiocyanates or more than 0.05 percent chloride ion.
7. Air entrainment between 3.5% and 6.5%
8. Maximum water-cementitious material ratio not to exceed 0.45 by weight of the total cementitious constituent,
9. Establish concrete proportions including the water-cementitious material ratio on the bases of field experience or trial mixtures with the materials to be used in accordance with Section 5.3 of ACI 318,
10. For ready-mixed concrete, meet the requirements of ASTM C 94.

PART 3 EXECUTION

3.1 WORKING BASE

- A. As a working base for all new, reinforced concrete structural foundation elements supported on soil provide a concrete workmat having a minimum thickness of 2 inches.

3.2 REINFORCING STEEL PLACEMENT

- A. Clean and bend reinforcement in accordance with ACI 315 and ACI 318. Place all bars in accordance with CRSI “Recommended Practice for Placing Reinforcing Bars” and the following:
 1. Cut bars to required length and bend accurately before placing.
 2. Bend bars in the shop unless written approval for field bending is obtained. If permitted, field bend bars only when the air temperature where the bending operation if performed is above 30 degrees F. Do not field bend bars that have been partially embedded in concrete.
 3. Place bars at the location shown. Tolerance for bar placement is 1/4-inch.

4. Provide lap splices for reinforcing bars as shown.
 5. Provide 2-inch of concrete protection (cover) for bars at the top, bottom and ends of the structural components.
- B. Concrete Cover: Place reinforcing steel and hold in position so that the concrete cover, as measured from the surface of the bars to the surface of concrete, is as shown or specified.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.

3.4 CURING CONCRETE

- A. Follow the recommendations of ACI 308 for curing concrete.
- B. During hot weather, follow ACI 305R.
- C. During cold weather, follow ACI 306R, except that set-accelerators will not be permitted.

3.5 VIBRATING CONCRETE

- A. Consolidate all concrete (by means of standard immersion vibrators) in accordance with the recommendations of ACI 309.

3.6 CONCRETE TESTING

- A. Take concrete samples for slump and strength testing for each day concrete is placed and report test results to the ENGINEER.
- B. Test slump in accordance with ASTM C 143. Acceptable slump limits: Normal 3-inch to 4-inch and Pumped 4-inch to 6-inch.
- C. Take samples for strength tests consisting of four cylinders from the same batch of concrete. Take samples in accordance with ASTM C 172. Mold and laboratory cure cylinders in accordance with ASTM C 31. Test two cylinders at 7 days and two at 28 days in accordance with ASTM C 39.
- D. Consider the strength level of the concrete mix for each individual class of concrete acceptable when the average of three consecutive 28-day strength tests (average of two cylinders) equal or exceed the 28-day specified compressive strength.

- E. If any individual 28-day concrete strength test result falls below the minimum 28-day compressive strength by more than 500 psi, take test cores from the area in question. Take three cores for each failed strength test in accordance with ASTM C 42. Concrete in the area represented by core tests will be accepted if the average of three cores is equal to or greater than 0.85 of the minimum 28-day compressive strength and no single core is less than 0.75 of the minimum 28-day compressive strength. Remove and replace concrete, which does not meet the core test requirements.

3.7 JOINTS AND BONDING

- A. Joints: Make construction joints, where shown, to ensure stability, strength, and watertightness. Build all corners monolithically, and continuously concrete on either side to points shown.
- B. Provide horizontal, continuous, straight, and regular keys in joints, as shown.
- C. Grout Use Between Surfaces: Thoroughly clean and wet concrete surfaces against which the new concrete is to be placed. Just prior to placing new concrete, slush horizontal surfaces and joints with at least 2 inches of cement grout of the same mixtures as the concrete but with coarse aggregate omitted.

3.8 CONCRETE SURFACES

- A. Finish exposed top edges of walls with a 1/2-inch beveled edge.
- B. Provide a trowel finish on top slab surface and top of exposed walls.
- C. For interior working spaces, provide screeded, wood-floated, steel-troweled surface finish
- D. Immediately after stripping the forms, inspect all concrete surfaces. Remove all fins, offsets, burrs, ridges, or other unsightly marks from the exposed concrete.
- E. Plug tie holes and patch placement joints, voids, stone pockets, or other defective areas before the concrete is thoroughly dry. Chip away defective areas to a depth of not less than 1 inch with all edges perpendicular to the surface. Wet the area to be patched, including at least 5 inches of the adjoining surface, prior to the placing the patching mortar. Then scrub onto the surface a grout of equal parts of cement and sand mixed to a brushing consistency followed immediately by the patching mortar. Make the patch of the same material and of approximately the same proportions as used for the concrete, except omit the coarse aggregate. For exposed concrete, substitute white cement for part of the gray cement so that the

patch will match the color of the surrounding concrete. Use as little water as consistent with the requirements of handling and placing. Do not retemper mortar. Thoroughly compact and screed off the mortar so as to leave the patch slightly higher than the surrounding surface. Then leave it undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. Finish the patch to match the adjoining surface and cure as specified for the original concrete.

3.9 SACK FINISH

- A. Sack Finish: Finish smooth, exposed, in view surface including vertical surfaces and undersides of slabs, stairs and platforms with a rubbed sack finish.
1. Saturate surfaces thoroughly with water and keep wet during the entire operation. Apply uniformly by a brush, plasterer's trowel, or rubber float a grout of 1 part Portland cement and 1-1/2 to 2 parts fine sand.
 2. Floating: Immediately after applying the grout, vigorously float the surface with a wood, sponge rubber, or cork float to fill any small air holes. Scrape off excess grout with a sponge rubber float. If the float pulls grout from the holes, use a sawing motion.
 3. Procedure for Grout Placement: Allow the grout remaining on the surface to stand undisturbed until it loses some of its plasticity but not its damp appearance. Then rub the surface with clean, dry burlap to remove all excess grout. Provide sufficient materials and workmanship such that all air holes remain filled, with no visible film of grout remaining after the rubbing. Complete any section being finished with grout the same day.
 4. Placement Timing: If possible, do the work during cool damp weather. During hot and dry weather, keep the concrete moist with a fine fog spray during the sack finishing. Moist cure the completed surface by keeping the area wet the entire day following the operation. Do not begin the rubber sack finishing until all defects have been repaired.

3.10 FINISH CONCRETE LOADING

- A. Do not backfill against walls until concrete has reached the minimum 28-day compressive strength.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03.35.11
CONCRETE FLOOR FINISHES

PART 2 PRODUCTS

1.01 CONCRETE FLOOR FINISH APPLICATIONS

- A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

1.02 DENSIFIERS AND HARDENERS

- A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.

1.03 COATINGS

- A. Clear, Penetrating, Moisture Vapor-Resistant Coating: Vapor-resistant and pH-reducing coating recommended by manufacturer for new and existing concrete floors and slabs.
 - 1. Type: High solids epoxy; two-component.
 - 2. Products:
 - a. LATICRETE International, Inc; Vapor Ban Primer ER: www.laticrete.com/#sle.
 - b. Rust-Oleum Corporation; TVB 100% Solids Topside Vapor Barrier: www.rustoleum.com/#sle.
 - c. Rust-Oleum Corporation; TVB Water-Based Topside Vapor Barrier: www.rustoleum.com/#sle.
 - d. Substitutions: See Section 01.60.00 - Product Requirements.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

2.02 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

2.03 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

- C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

2.04 CONCRETE POLISHING

- A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
 - 1. Final Polished Sheen: Satin finish; other sheens are included as comparison to illustrate required sheen; final sheen is before addition of any sealer or coating, regardless of whether that is also specified or not.
 - 2. Satin Finish: Reflecting images from side lighting.

END OF SECTION

SECTION 07.21.00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at over roof deck.
- B. Batt insulation and vapor retarder in exterior wall and ceiling construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

1.04 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.
- B. Insulation Over Roof Deck: Extruded polystyrene (XPS) board.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.

1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 3. Board Size: 48 inch by 96 inch.
 4. Board Thickness: 2 inch.
 5. Board Edges: Shiplap.
 6. Water-Resistive Barrier: Integrated film facer on insulation.
- B. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 2. Formaldehyde Content: Zero.
 3. Thermal Resistance: R-value R-value of 11 19.
 4. Thickness: 3.5 inch.
 5. Facing: Aluminum foil, one side.
 6. Products:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 - d. Substitutions: See Section 01.60.00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

- A. Installation of board insulation over steep slope roof structure or roof sheathing, see Section 06.10.00.

3.03 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.04 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements for additional requirements.

END OF SECTION

SECTION 07.61.00
SHEET METAL ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet metal roofing, associated flashings, and underlayment.
- B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- E. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments 2012, with Editorial Revision (2015).

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal types, finishes, characteristics.
- C. Color Samples: Submit two samples 6 by 6 inches in size illustrating metal finish color.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

1.06 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a 5-year period after Date of Substantial Completion. Defective work includes degradation of metal finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sheet Metal Roofing Manufacturers:
 - 1. Petersen Aluminum Corporation; [____]: www.pac-clad.com/#sle.
 - 2. Sheffield Metals International; Galvalume: www.sheffieldmetals.com/#sle.
 - 3. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; 24-gauge, 0.0239-inch minimum base metal thickness, shop precoated with polyvinylidene fluoride (PVDF) coating; color as selected.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, thickness to match roofing sheet, and at least [____] inch wide, interlockable with sheet.
- C. Fabricate starter strips, interlockable with sheet.
- D. Form pieces in longest practical lengths.
- E. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- F. Form material with standing seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

2.04 FINISHES

- A. Polyvinylidene Fluoride (PVDF) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
- B. Color: As selected by Architect from manufacturer's standard colors.
- C. Primer Coat: On coated sheets, finish concealed side of sheet with primer compatible with finish system as recommended by finish system manufacturer.

2.05 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.

- B. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
 - 1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
 - 2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 3. Ultraviolet Resistance and Weatherability: Approved in writing by manufacturer for exposure to weather for minimum of 12 months.
 - 4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 - 5. Fasteners: As specified by manufacturer and building code qualification report or approval, if any.
- C. Concealed Sealants: Non-curing butyl sealant or butyl tape.
- D. Exposed Sealants: ASTM C920 elastomeric sealant, with minimum movement capability as recommended by manufacturer for sealed substrates; color to match adjacent material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.
- B. Verify deck is dry and free of snow or ice. Verify joints in wood deck are solidly supported and fastened.
- C. Verify correct placement of wood nailers and insulation positioning between nailers.
- D. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

- A. Roofing:
 - 1. Apply underlayment over entire roof area, as follows:
 - a. Apply in single layer, laid perpendicular to slope; weather lap edges 2 inches and nail in place.
 - b. Minimize number of nails used.
 - 2. Apply slip sheet in one layer, laid loose.
 - 3. Cleat and seam sheet metal roofing joints.
 - 4. Use butyl tape to seal concealed joints between metal roofing surfaces.
- B. Standing Seam Roofing:
 - 1. Lay sheets with long dimension perpendicular to eaves. Apply pans beginning at eaves.
 - 2. Lock cleats into seams and flatten.
 - 3. Stagger transverse joints of roofing sheets.

4. At eaves and gable ends, terminate roofing by hooking over edge strip.
5. Bend up one side edge 1-1/2 inches and other edge 1-3/4 inches.
6. Make first fold 1/4-inch wide single fold and second fold 1/2 inch wide, providing locked portion of standing seam, five plies in thickness.
7. Fold lower ends of seams at eaves over at 45 degree angle.

3.04 PROTECTION

- A. Do not permit traffic over unprotected roof surface.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 08 Section "Access Control Hardware".
6. Division 08 Section "Sanitary and Water Tight Doors and Frames"
7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
 - 1. Design: Flush panel.
 - 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
 - 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors – Reference Section 083919
- D. Manufacturers Basis of Design:
 - 1. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.
 - 2. Curries Company (CU) – 780 Series – Interior Doors.

2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

- B. Weatherstripped Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated weatherstripped profiles with 1/8" integral kerf formed into the frame soffit able to receive manufacturer's listed gasket material. Available for use in both masonry and drywall construction, with fire rating up to 3 hours complying with NFPA 105, UL 1784, and ASTM E-283 Test criteria.
- C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) – Kerfed Weatherstripped WM Series.
- D. Interior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
 - 1. Reference Section 083919
 - 2. Manufacturers Basis of Design:
 - a. Curries Company (CU) - C Series.
 - b. Curries Company (CU) - M Series.
- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

5. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.

- 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jamb and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

- d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

SECTION 08 39 19 - SANITARY AND WATERTIGHT DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Sanitary/watertight swinging doors and frames.

- B. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
- 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
- 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
- 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 8. ASTM A924 - Standard Specification General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process.
- 9. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- 10. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
- 11. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
- 12. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
- 13. UL 10C (1998) - Positive Pressure Fire Tests of Door Assemblies; UL 1784 (2001) - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of preparations for power, signal, and control systems.
- D. Samples for Verification:
 - 1. Samples are only required by request of the architect and for manufactures that are not current members of the Steel Door Institute.
- E. Informational Submittals:
 - 1. Certificates of Compliance: Submit any information necessary to indicate compliance with this specification section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sanitary/watertight steel work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store sanitary/watertight steel work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate installation of anchorages for sanitary/watertight steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.7 WARRANTY

- A. Provide manufacturer's written 5 year warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CECO Door Products.
 - 2. Curries Company.
- B. Substitutions: Material from alternate sanitary/watertight steel door and frame fabricators will not be accepted on jobsite without prior written and sample approval in accordance with requirements specified in Division 01.

2.2 MATERIALS

- A. General: Sanitary/watertight doors and frames to be manufactured of commercial quality galvanized steel complying with ASTM A924/A924M, or ASTM A653/A653M, with a minimum coating of G90. Door and frame corners, seams, closures and channels shall be welded and sealed watertight.
- B. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Glazing: Comply with requirements in Division 08 Section, "Glazing."

2.3 SANITARY/WATERTIGHT STEEL DOORS

- A. General: Provide 1-3/4 inch doors of type and design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral core, or vertical steel-stiffener core.

- a. Polystyrene and Polyurethane Doors: Manufacturer's standard polystyrene or polyurethane core permanently bonded to both faces.
 - b. Standard Vertical Steel-Stiffener Core: Minimum 22 gage steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces inside and between stiffeners to be completely filled with inorganic non-combustible batt-type insulation. Organic materials including, but not limited to, wood, paper, cardboard, glue, mastics, resins or fillers are not acceptable.
 - c. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gage (0.053-inch - 1.3-mm) thick steel, Model 2 (Fully welded, seamless face and edges).
 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gage (0.053-inch - 1.3-mm), extending the full width of the door and welded to the face sheet. Finish top and bottom to provide a smooth flush condition.
 6. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2.4 SANITARY/WATERTIGHT STEEL FRAMES

- A. General: Provide frames of the type and profile indicated, not less than thickness indicated; to comply with ANSI/SDI A250.8.
 1. Fabricate frames with mitered corners.
 2. Fabricate frames with "closed and tight" mitered, full depth continuously welded seams, finished smooth with no visible seam unless otherwise indicated. Knock down type frames are not permitted.
 3. Minimum 16 gage (0.053-inch -1.3-mm) thick steel sheet
 4. Provide where indicated cutoff stops not to exceed 6" in height and capped at a 45 degree angle. Filler shall be welded watertight.
- B. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- C. Surface Applied Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 STOPS AND GLAZED LITES

- A. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 16 gage (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

2.6 FABRICATION

- A. Fabricate sanitary/watertight steel work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate sanitary/watertight steel work to tolerances indicated in ANSI/SDI A250.8.
- C. Sanitary/Watertight Steel Doors and Frames:
 - 1. Sanitary Water Tight Design Doors: Where indicated, provide optional sanitary design to completely seal door against water penetration. Hardware cutouts to be completely sealed to prevent water penetration inside of the door.
 - 2. Glazed Lites: Factory cut openings in doors with fixed glass molding flush with the door skin and removable glass molding overlapping and welded into a single "picture frame" assembly. Glass cutouts to be completely sealed to prevent water penetration inside of the door.
 - 3. Astragals: Provide overlapping astragals on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Division 08, Section "Door Hardware".
- D. Sanitary/Watertight Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Full depth continuously weld frame seams; grind, fill, dress, and make smooth and flush.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 3. High Frequency Hinge Reinforcement: Provide 12 gage angle reinforcements for butt type hinges on every door and frame assembly.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gage straps for continuous hinges specified in hardware sets in Division 08 Section, "Door Hardware".
 - 5. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; this includes but not limited to electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as noted in door hardware sets in Division 08 Section, "Door Hardware".

- a. Provide electrical knock out boxes as required for Project.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section, "Door Hardware".
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. Jamb Anchors: Provide number and spacing of anchors as follows:
- a. Masonry and Stud Wall Types: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 84 inches (2137 mm) high.
- E. Surface Hardware Preparation: Factory prepare sanitary/watertight steel work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section, "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of sanitary/watertight steel work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
- F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of sanitary/watertight steel work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so glazed lites are capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
- 2.7 STEEL FINISHES
- A. Prime Finish: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded sanitary/watertight steel frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including sanitary/watertight steel work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from sanitary/watertight steel work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

- 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 083919

SECTION 08.53.13
VINYL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vinyl-framed, factory-glazed windows.
- B. Operating hardware.
- C. Insect screens.

1.02 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights 2017.
- B. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products 2021.
- C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- D. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).
- E. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.
- F. ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation 2022.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, anchors, fasteners, and internal drainage.
- C. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.
- D. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
- B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.06 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F.
- B. Maintain this minimum temperature during and after installation of sealants.

1.07 WARRANTY

- A. See Section 01.78.00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a 5-year period after Date of Substantial Completion.
- C. Manufacturer's Warranty: Provide five-year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of vinyl color finish. Complete form in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Vinyl Windows:
 - 1. Alside, Inc: www.alside.com/#sle.
 - 2. Innotech Windows and Doors; Defender 76TS System: www.innotech-windows.com/#sle.
 - 3. Pella Corporation; Encompass by Pella Vinyl Windows: www.pellacommercial.com/#sle.
 - 4. Prime Window Systems, LLC; Silent Guard Acoustic Series 7000: www.primewindowsys.com/#sle.
 - 5. Quaker Window Products Company: www.quakercommercialwindows.com/#sle.
 - 6. Substitutions: See Section 01.60.00 - Product Requirements.

2.02 DESCRIPTION

- A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
 - 1. Configuration: As indicated on drawings.
 - a. Product Type: H - Hung window, vertically sliding in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 2. Color: White.

3. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
4. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
5. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
6. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
7. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame.
8. Insect Screens: Tight fitting for operating sash location.

2.03 PERFORMANCE REQUIREMENTS

- A. Design Pressure: In accordance with applicable codes.
- B. Acoustic Performance: Minimum outdoor-indoor transmission class (OITC) rating of 34, when tested in accordance with ASTM E90 and ASTM E1332.

2.04 COMPONENTS

- A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, manufacturer's standard fill, with glass thicknesses as recommended by manufacturer for specified wind conditions.
- B. Frame Depth: 2-11/16 inches.
- C. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
 1. Hardware: Manufacturer's standard; quantity as required per screen.
 2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's 18 x 16 mesh.
 3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.

2.05 HARDWARE

- A. Vertical Sliding Sash: Metal and nylon spiral friction slide cylinder, provide two for each sash and jamb.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive this work.

3.02 INSTALLATION

- A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.

- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.
- C. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

3.04 FIELD QUALITY CONTROL

- A. Provide services of vinyl window manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 01.40.00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- C. Provide field testing of installed vinyl windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
 - 1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf.
 - 2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 6.27 psf.
- D. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

3.06 CLEANING

- A. See Section 01.74.19 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

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 commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Sanitary and Watertight Doors and Frames".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.

2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
 - C. Shop Drawings: Details of electrified access control hardware indicating the following:
 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
 - E. Informational Submittals:
 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
 - F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
 - F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
 - G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
 - H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
 - I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - e. One additional hinge on doors 3'8" wide to 4'0" wide up to 90-inches high when the door is using a door closer.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

- a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
- a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 1) Interior door that is 3'8" to 4'0" wide, require heavy weight hinges.
4. Hinge Options: Comply with the following:
- a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
- a. McKinney (MK) - TA/T4A Series, 5 knuckle.

2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
- a. Securitron (SU) - EL-CEPT Series.
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
- a. McKinney (MK) - Electrical Connecting Kit: QC-R001.

- b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. McKinney (MK) - QC-C Series.

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
 4. Construction Control Keys (where required): Two (2).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Construction Keying: Provide temporary keyed construction cores.
- G. Key Registration List (Bitting List):
 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

- a. Lund Equipment (LU).
- b. MMF Industries (MM).
- c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Heavy duty mortise locks shall have a ten-year warranty.

2. Where specified, provide status indicators with highly reflective color and wording for “locked/unlocked” or “vacant/occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1” x 0.6” with a curved design allowing a 180-degree viewing angle with protective covering to prevent tampering.

3. Manufacturers:

- a. Corbin Russwin Hardware (RU) - ML2000 Series.
- b. Sargent Manufacturing (SA) - 8200 Series.
 - 1) Lever design to match facility standards

2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 - B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.

2.9 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 25-year warranty.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Rixson (NO) - 7500 Series.
 - c. Sargent Manufacturing (SA) - 351 Series.
- C. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.
 1. Manufacturers:
 - a. Corbin Russwin (RU) - DC5000 Series.
 - b. Norton Rixson (NO) - 2800ST Series.
 - c. Sargent Manufacturing (SA) - 422 Series.

2.10 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

- a. Rockwood (RO).

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

- a. Rockwood (RO).

- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

- a. Norton Rixson (RF).

2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).

2.13 ELECTRONIC ACCESSORIES

- A. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.
 - 1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 2. Manufacturers:
 - a. Securitron (SU) - AQL Series.

2.14 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.15 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
 - B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
 - C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal,

storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Door Closers:

1. Install closers on room side of corridor doors, and stair side of stairways.
2. Lobby doors: Mount on vestibule side.
3. Exterior doors: Parallel rigid arm installation.
4. Where through-bolts are required, install closers using only manufacturer-furnished through-bolts.
5. Install closers using only manufacturer-furnished template machine screws for metal doors and manufacturer -furnished wood screws for wood doors.
6. Coordinate with door supplier to provide proper blocking for surface mounting.
7. Use of self-drilling or self-tapping fasteners is not allowed.
8. Where full glazed door units are specified, use closer arm and mounting configuration as required to avoid use of drop brackets whenever possible.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handling and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
 - 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Manufacturer's Abbreviations:
 - 1. MK - McKinney
 - 2. MR - Markar
 - 3. SU - Securitron
 - 4. SA - SARGENT
 - 5. RF - Rixson
 - 6. RO - Rockwood
 - 7. PE - Pemko
 - 8. CR - Curries (Hardware Only)

Hardware Sets**Set: 1.0**Doors: [102.2](#)






Exterior: Rim Exit Device (storeroom) x Overhead Stop x Door Closer

Hinge (qty per spec)	T4A3386 (size per spec, NRP as applicable)	US32D	MK
1 Rim Exit Device	(12) 43 8806 ET	US32D	SA
1 Permanent Core	As Specified	US15	
1 Surf Overhead Stop	9-X36	630	RF
1 Surface Closer	351 P3(A)	EN	SA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Threshold	252x__FG		PE
1 Rain Guard	346_		PE
1 Sweep	345_PK		PE
1 Kerf Weather Seal	by frame manufacturer		CR

Door Type: Curries 777E (or equal)

Set: 2.0Doors: [101](#)

Exterior - Card Reader: EL Lock (SN) x Overhead Stop x Door Closer

Hinge (qty per spec)	T4A3386 (size per spec, NRP as applicable)	US32D	MK
1 Electric Power Transfer	EL-CEPT	630	SU 
1 Access Control Mort Lock	SN2_0-82271	US32D	SA 
1 Permanent Core	As Specified	US15	
1 Surf Overhead Stop	9-X36	630	RF
1 Surface Closer	351 P3(A)	EN	SA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Threshold	252 / 253 x__FG		PE
1 Rain Guard	346_		PE
1 Sweep	345_PK		PE
1 Kerf Weather Seal	by frame manufacturer		CR
1 ElectroLynx Harness	QC-C00_		MK 
1 ElectroLynx Harness	QC-C3000_		MK 
1 Power Supply	AQL4-B100R8E1		SU 
1 Set Wiring Diagrams	By Security Contactor		00

Door Type: Curries 777E (or equal)

Application:

-Card reader is integrated with lock and mounted on face of door.

Door normally closed and locked.

Entrance by presenting a valid card to card-reader.

Egress allowed at all times.

Loss of power maintains security from lock side, entrance by mechanical key only.

Door monitored for door ajar and forced open.

-internal door position monitoring, standard feature, is built into latching hardware through the use of latch bolt and deadlatch monitoring.

-internal switch within latching hardware allows an individual to freely leave without sending an alarm to the access control system.

Set: 3.0

Doors: [102.1](#)

Rim Exit Device (storeroom) x Door Closer

Hinge (qty per spec)	TA2314 (size per spec, NRP as applicable)	US32D	MK
1 Rim Exit Device	(12) 43 8806 ET	US32D	SA
1 Permanent Core	As Specified	US15	
1 Surface Closer	351 P10	EN	SA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Wall Stop	RM860 / RM861	US32D	RO
1 Gasketing	S88		PE

Door Type: Curries 780 (Water Resistant or equal)

Set: 4.0

Doors: [103](#), [105](#)

Storeroom Lock x Closer

Hinge (qty per spec)	TA2314 (size per spec, NRP as applicable)	US32D	MK
1 Storeroom Lock	8204	US32D	SA
1 Permanent Core	As Specified	US15	
1 Surface Closer	351 O / 351 P10	EN	SA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Wall Stop	RM860 / RM861	US32D	RO
1 Gasketing	S88		PE

Door Type: Curries 780 (Water Resistant or equal)

Set: 5.0

Doors: [104](#)

Privacy Lock w/ Indicator x Door Closer

Hinge (qty per spec)	TA2314 (size per spec)	US32D	MK
1 Privacy Lock	V21 8266	US32D	SA
1 Surface Closer	422 CTB2 / 422 PCTB2	EN	SA
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO

1 Coat Hook	RM840	US32D	RO
1 Gasketing	S88		PE

Door Type: Curries 780 (Water Resistant or equal)

END OF SECTION 08 71 00

SECTION 09.21.16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06.10.00 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 09.22.16 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing 2020.
- C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing 2015, with Errata (2020).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- F. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.

- J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- K. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- O. ASTM E413 - Classification for Rating Sound Insulation 2022.
- P. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.
- B. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
 - 2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 Delivery, Storage, and Handling

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
 1. Fire-Resistance-Rated Partitions: [____]; 2 hour rating.

2.02 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
- B. Nonstructural Steel Framing for Application of Gypsum Board: See Section 09.22.16.
- C. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
 1. Studs: C-shaped with knurled or embossed faces.
 - a. Products:
 - 1) MBA Building Supplies; ProSTUD: www.mbastuds.com/#sle.
 - 2) R-stud; R-stud: www.rstud.com/#sle.
 - 3) Super Stud Building Products, Inc; The EDGE: www.buysuperstud.com/#sle.
 - 4) Substitutions: See Section 01.60.00 - Product Requirements.
 2. Runners: U shaped, sized to match studs.
 3. Ceiling Channels: C-shaped.
 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
 - a. Products:
 - 1) MBA Building Supplies; MBA Furring Channel: www.mbastuds.com/#sle.
 - 2) Substitutions: See Section 01.60.00 - Product Requirements.
 5. Furring Members: U-shaped sections, minimum depth of 3/4 inch.
 - a. Products:
 - 1) MBA Building Supplies; MBA U-Channel: www.mbastuds.com/#sle.
 - 2) Substitutions: See Section 01.60.00 - Product Requirements.
 - D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 1. American Gypsum Company; [____]: www.americangypsum.com/#sle.
 2. CertainTeed Corporation; [____]: www.certainteed.com/#sle.
 3. Georgia-Pacific Gypsum; [____]: www.gpgypsum.com/#sle.
 4. Gold Bond Building Products, LLC provided by National Gypsum Company; [____]: www.goldbondbuilding.com/#sle.
 5. PABCO Gypsum; [____]: www.pabco gypsum.com/#sle.
 6. USG Corporation; [____]: www.usg.com/#sle.

7. Substitutions: See Section 01.60.00 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required in restroom..
 4. Thickness:
 - a. Vertical Surfaces: 1/2 inch.
 - b. Ceilings: 1/2 inch.
- C. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 1/2 inch.
 3. Edges: Tapered.
 4. Products:
 - a. CertainTeed Corporation; Interior Ceiling Drywall: www.certainteed.com/#sle.
 - b. CertainTeed Corporation; 1/2" Easi-Lite: www.certainteed.com/#sle.
 - c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board: www.gpgypsum.com/#sle.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond High Strength LITE Gypsum Board: www.goldbondbuilding.com/#sle.
 - e. USG Corporation; Sheetrock Brand UltraLight Panels 1/2 in. (12.7 mm): www.usg.com/#sle.
 - f. Substitutions: See Section 01.60.00 - Product Requirements.

2.04 GYPSUM BOARD ACCESSORIES

- A. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
- B. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
 - 2) ClarkDietrich; Strait-Flex Big-Stick: www.clarkdietrich.com/#sle.
 - 3) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.
 - 4) Substitutions: See Section 01.60.00 - Product Requirements.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 2. Joint Compound: Setting type, field-mixed.

- D. Finishing Compound: Surface coat and primer, takes the place of skim coating.
 - 1. Products:
 - a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat:
www.certainteed.com/#sle.
 - b. Substitutions: See Section 01.60.00 - Product Requirements.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center.
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - 3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet accessories.
 - 5. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.

3.06 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.08 Cleaning

- A. See Section 01.70.00 - Execution and Closeout Requirements for additional requirements.
- B. Clean [_____].

3.09 Protection

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 09.91.23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- C. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- D. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.03 SUBMITTALS

- A. See Section 01.30.00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 1. Where sheen is specified, submit samples in only that sheen.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.

- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.
 - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 - 3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.
 - 1. Two top coats and one coat primer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Plaster and Stucco: 12 percent.
 - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:
- F. Masonry:
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

- H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- J. Galvanized Surfaces:
- K. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- L. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01.40.00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

- A. Gypsum Board: Finish surfaces exposed to view.
 - 1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
 - 2. Interior Walls: GI-OP-3A, semi-gloss.
- B. Steel Doors and Frames: Finish surfaces exposed to view; MI-OP-3A, gloss.

END OF SECTION

SECTION 12 35 53.13 – METAL LABORATORY CASEWORK

PART 1 - PRODUCTS

1.1 METAL LABORATORY CASEWORK

- A. Casework: Die-formed metal sheet; each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.
1. Style: Flush overlay – square edge.
 2. Steel Sheet Metal:
 - a. Gables, Front and Back Panels, Gusset Plates, Aprons, and Rails: 18 gauge, 0.0478-inch minimum thickness.
 - b. Drawers, Cabinet Floors, Shelves, Filler Panels and Drawer Dividers: 20-gauge, 0.0359-inch minimum thickness.
 - c. Backing Sheet to Door and Door Fronts: 22-gauge, 0.0299-inch minimum thickness.
 3. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7 and SEFA 8M, provide components that safely support the following minimum loads, without deformation or damage:
 - a. Base Units: 500 pounds per linear foot across the cabinet ends.
 4. Corners and Joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
 5. Edges and Seams: Smooth. Form counter tops, shelves and drain boards from continuous sheets.
 6. Shelf Edges: Turned down $\frac{3}{4}$ inch on each side and returned $\frac{3}{4}$ inch front and back.
 7. Ends: Close open ends with matching construction.
 8. Welding: Electric spot welded; joints ground smooth and flush.
 9. Drawers and Doors: Fabricate drawer and door fronts of sandwiched sheets of sheet steel welded together and reinforced for hardware.
 - a. Fill with sound-deadening core.
 10. Stainless Steel Finish: No. 4, brushed finish.
 11. Separation: Use bituminous paint or non-conductive tape to coat metal surfaces in contact with cementitious materials, and to separate dissimilar metals.
 12. End Splash: None.

1.2 FINISHES

- A. Sheet Steel Finish: Having chemical resistance equal to Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8M. Test applied finishes using procedures specified in ASTM D522/D522M.

1. Coating Type, New Casework: Baked on epoxy; minimum two coats.
2. Color: As selected from manufacturer's standard selection.
3. Preparation: Degrease and phosphate etch, and prime.

END OF SECTION 12 35 53.13

SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material apron fronts.
3. Solid surface material sinks.

- B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for plumbing fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.

- B. Shop Drawings: For countertops. Show materials, finishes and edge profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

- C. Samples for Initial Selection: For each type of material exposed to view.

- D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size solid surface material countertop, with front edge, 8 by 10 inches, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled phenolic resin complying with ICPA SS-1.
 - 1. LF Systems
 - 2. Type: Provide Standard type unless Special Purpose type is indicated.
 - 3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
 - 4. Colors and Patterns: As selected by Architect from manufacturer's full range.
- B. Particleboard: ANSI A208.1, Grade M-2.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

- A. Configuration:
 - 1. Front: Straight, slightly eased at top
 - 2. Backsplash: None.
 - 3. End Splash: None.
- B. Countertops: 1-inch-thick, solid surface material with front edge built up with same material.
- C. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Install integral sink bowls in countertops in the shop.
- D. Joints: Fabricate countertops without joints.
- E. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
 - c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.
 - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Install aprons to backing and countertops with adhesive. Mask areas of countertops adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Pre-drill holes for screws as recommended by manufacturer.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 12 3661.16

**SECTION 220501
COMMON WORK RESULTS FOR PLUMBING**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.
- B. INDIANA CODES
 - 1. General Administration Rules (675 IAC 12): Amended 12/01/2014
 - 2. Building Code: Effective 12/01/2014
 - 3. Fire Code: Effective 12/01/2014
 - 4. Plumbing Code: Effective 12/24/2012
 - 5. Electrical Code: Effective 08/26/2009
 - 6. Mechanical Code: Effective 12/01/2014
 - 7. Handicapped Accessibility Code: 2014
 - 8. Energy Code: Effective 05/07/2010
 - 9. Elevator Safety Code: 2011:
 - 10. Fuel Gas Code: Effective 12/01/2014

1.02 GUARANTEE

- A. In entering into a contract covering this work, the Contractor accepts the Specifications and Drawings and guarantees that the work will be carried out in accordance with the requirements of the Specifications and Drawings, or such authorized modifications as may be made in the Contract Documents. Contractor further guarantees that the workmanship and material will be first class and that only experienced workers, familiar with each particular class of work, will be employed. Contractor further guarantees to replace and make good at their own expense any defects due to faulty workmanship or material which may develop within one (1) year after final payment and acceptance by the Owner, upon receipt of written notification of defect from the Owner.

1.03 QUALITY ASSURANCE

- A. Regulations and Standards: All equipment, apparatus, and systems are to be fabricated and installed in complete accordance with fire and insurance rules and regulations, the Life Safety Code, and the latest edition or revision of the following applicable regulations, standards, and codes:
 - 1. AIA American Institute of Architects
 - 2. ASME American Society of Mechanical Engineers
 - 3. ASTM American Society for Testing and Materials
 - 4. NFPA National Fire Protection Association
 - 5. NEC National Electric Code
 - 6. OSHA Occupational Safety and Health Administration
 - 7. UL Underwriter's Laboratories, Inc.
 - 8. MCAA Mechanical Contractors Association of America, Inc.
 - 9. ANSI American National Standard Institute
 - 10. AWWA American Water Works Association
 - 11. AGA American Natural Gas Association
 - 12. PDI Plumbing and Drainage Institute
 - 13. NACE National Association of Corrosion Engineers
 - 14. State and Local Inspection Authorities
 - 15. Division 01 Sections "Regulatory Requirements: and "Reference Standards" of the Project Specifications
 - 16. References on the Drawings or in the Specifications to "code" or "building code" not otherwise identified shall mean the specific codes applicable to this Project location,

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together with all additions, amendments, changes, and interpretations adopted by code authorities having jurisdiction over this Project.

17. The applicable edition of all codes shall be that adopted at the time of issuance of permits by the authorities having jurisdiction, and shall include all modifications and additions adopted by that jurisdiction.
18. Give all required notices so as to comply with, and meet, all inspections required by Federal, State, and Local authorities.
19. It is not the intent herewith to modify, reduce, or change any rules, standards, regulations, or requirements that are applicable under local, state and federal codes, ordinances, or regulations of the various authorities having jurisdiction. Where the standards differ among the various authorities, the most restrictive shall apply. Where the requirements shown on the Drawings or called for in the Specifications exceed code requirements, these Drawings and Specifications shall take precedence. Where the requirements within the specifications of this division of work and the Drawings conflict with the referenced Divisions, Sections, and other documents, the documents having the most restrictive and the higher cost requirements shall apply.

1.04 JOB CONDITIONS AND COORDINATION

A. Local Conditions

1. Each Trade Contractor is to inform himself of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work to be done.
2. Utility Coordination: Contractors shall contact, coordinate, and review indicated utility data with the local utility companies. Verify existing utility locations, verify new pipe tap locations and piping routes with the utility.
 - a. Water: Contractor to verify water meter and backflow requirements.
 - b. Gas: Contractor to verify meter requirements.
 - c. Sewer: Contractor to verify all proposed sewer connection points.

B. Present Job Site Inspection

1. Each contractor shall schedule through the Construction Manager a visit to the present site proposed for the work before presenting a Bid and shall make a careful inspection of the existing conditions.
2. During the site visit, each Trade Contractor is to investigate for any existing conditions and responsibilities which are not clearly defined by the Drawings and Specifications. If any such conditions exist, they shall bring them to the attention of the A/E in writing. The A/E will then make the required written clarification. The absence of questions before the opening of bids shall indicate a clear understanding of the scope of work and the Contractor's responsibility.

C. Concrete Housekeeping Pads and Supporting Foundations

1. Unless otherwise specified or noted on the Drawings, the Concrete Contractor is to provide concrete pads and foundations as indicated on the Drawings for all mechanical equipment.
2. Unless otherwise specified or noted on the Drawings, the Contractor or Subcontractor whose equipment the concrete pad or foundation services is to locate, size, and pay the Concrete Contractor to provide concrete pads and foundations as indicated on the Drawings for all of their equipment.
3. Concrete pads as may be indicated are based upon the design and layout-based manufacturer and model of equipment and devices as specified or as scheduled or noted on the Drawings.
4. The individual Trade Contractor furnishing the equipment or devices is to verify and coordinate all concrete pad sizes so as to have same of proper size to serve the equipment or device supplied and verify the position of all anchor bolts.

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5. Any additional cost for larger than indicated pad or foundation sizes to fit the approved manufacturer and model of the equipment or devices is to be borne by the Trade Contractor who supplies such equipment or devices.
 6. Concrete equipment pads shall extend a minimum of 6" beyond the equipment of product mounted thereon.
 7. Contractor shall verify equipment pad size and locations with nearby floor drain locations.
- D. Permits and Fees: This Contractor is to obtain all permits and pay all fees required for the work under Division 22 of the Work.
- E. Royalties and Patents
1. The Trade Contractor is to pay all royalties and license fees. They shall defend, indemnify, and hold the Owner and A/E harmless from any and all suits, demands or claims for infringement of any patent rights.
 2. The review by A/E or Owner of any method of construction, invention, appliance, process, article, device or material of any kind is to be for adequacy of work and is not to be construed as an approval of the use thereof by the Contractor in violation of any patent or other rights of any third person.
- F. Wiring and Conduit Requirements: In general, most wiring and conduit requirements are addressed, either upon the Drawings as a part of a packaged equipment assembly specifications, or within Divisions 26, 27 and 28 of the Specifications. However, should an equipment component, panel, or system device need additional wiring and conduit so as to be complete, approved and fully operational, the Contractor who supplied the equipment component, panel or system device shall be responsible for the required wiring and conduit as well as circuit disconnect and protection for same when it is not otherwise covered by the Project Drawings and Specifications.
- G. Coordination: Coordinate the exact location of this work with the work of other trades prior to fabrication or installation of same. Verify all dimensions and elevations. Provide additional offsets and sections of material as may be required to meet the applicable job condition requirements. Coordinate with and review all related construction Drawings and Shop Drawings of all equipment suppliers prior to start of work.

1.05 SPECIFICATIONS AND DRAWINGS

- A. These specifications and Drawings are intended to describe and provide for a complete and finished project. They are intended to be complementary. All items of work called for by either shall be as binding as if called for by both. The work described shall be complete in every detail, notwithstanding the fact that every item necessarily involved is not particularly mentioned or shown. If the Bidder, Supplier or Contractor sees anything to question, it must be brought to the attention of the A/E immediately.
- B. Minor Deviations: The Drawings accompanying these Specifications indicate the general design and arrangement of equipment, apparatus, fixtures, accessories and piping necessary to complete the installation of the system. The exact location or arrangement of the apparatus and equipment, unless otherwise dimensioned, is subject to minor changes necessitated by field conditions and shall be required without additional cost to the Owner. Measurements shall be verified through actual observation at the construction site. Each Trade Contractor shall be responsible for fitting all of their work into place in a satisfactory and workmanlike manner, to the approval of the A/E and Owner.
- C. Provide all labor and materials necessary for the completion of the work described. Referenced codes and industry standards and methods shall apply when no other specifics are indicated. Bring questions relating to this paragraph to the attention of the A/E for resolution prior to the receipt of Bids.
- D. All Work indicated on Drawings, diagrams, or details in part only are to continue throughout unless distinctly marked otherwise. The same applies to other parts of the project where merely a typical reference plan, diagram, or section of the drawing is complete. The balance is

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intended to be the same as the typical plan, section, or diagram as shown and is to be figured accordingly.

- E. The specifications are divided into trades and divisions only for the distinct purpose of facilitating the work. However, the Trade Contractor will become responsible for furnishing all labor and materials necessary to complete the project as contemplated by the Drawings and Specifications. Any item mentioned under any heading of the Specifications must be supplied even though it is not called for again under the heading for the respective work.
- F. Should discrepancies occur within the Contract Documents, the more stringent and more costly approach shall apply for bidding purposes. The Contractor is to notify the A/E of discrepancies for clarification. Clarifications issued after the Contract is awarded shall be incorporated by the Contractor at no additional costs and shall be reviewed by the A/E to determine if a reduction in cost is justified.

1.06 TRADE CONTRACTORS, SUBCONTRACTORS AND SUPPLIERS

- A. The Trade Contractor is any person or organization who contracts to perform work for the Project. Wherever the word "Contractor" is used on the Drawings or in the Specifications, it shall be construed to mean the Trade Contractor applicable to the Title Division of these specifications.
- B. A Sub-Contractor is a person or organization who has a direct contract with a Trade Contractor to perform any of the Work at the site and includes all who furnish material worked to a special design in accordance with the Drawings and Specifications, but excludes suppliers or persons furnishing material not specially designed. Wherever the term "Sub-Contractor" is encountered in the Contract Documents, it shall mean the Sub-Contractor and/or their Sub-Sub-Contractors and/or their Material Suppliers.
- C. A Sub-Sub-Contractor is a person or organization who has a direct or indirect contract with a Sub-Contractor to perform any of the Work at the project site or for the subject project.
- D. A Material Supplier is a person or organization who has a direct contract with a Trade Contractor to furnish material not specially designed.
- E. It shall be the responsibility of each Trade Contractor to be fully familiar with various local trade jurisdictional requirements and to engage the services of any other Sub-Contractors as may be required within the various trades to complete all of the work as indicated upon the Drawings and within the Specifications under their respective division or section. Only Trade Sub-Contractors with established knowledge and skills of their specific trade shall be used, so that all work is performed in a complete, finished, and professional manner.
- F. Whenever any provisions of the Specifications conflict with any agreements or regulations in force among members of any Trade Associations, Unions, or Councils which regulate or distinguish what work shall or shall not be included in the work of any particular trade, the Trade Contractor shall make all necessary efforts to reconcile any such conflict without delay, damage or cost to the Owner.
- G. If the progress of the work is affected by any undue delay in furnishing or installing any items of material or equipment required under the contract because of a conflict involving any such agreement or regulation, the A/E may require that other material or equipment of equal kind and quality be provided at no additional cost to the Owner.
- H. Any Trade Contractor, subcontractor, or material supplier not normally employing union labor shall make all provisions necessary to avoid any resulting disputes with labor unions and shall be responsible for any delays, damages or extra cost caused by employment of such non-union labor, except as otherwise governable by state or federal rules and regulations.
- I. Each Trade Contractor shall pay for all applicable Federal, State and local taxes on all materials, labor or services furnished by him, and all taxes arising out of their operations under the Contract Documents which may be imposed upon or collectable from the Owner or become a lien against their property. Such taxes shall include, but not be limited to, Occupational, Sales, Use, Excise, Social Security and Unemployment Taxes, customs duties, and all income

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taxes and other taxes now in force or enacted prior to final acceptance of the work. The Trade Contractor shall assume all liability for the payment of and shall pay any unemployment benefits payable under any Federal or State law to individuals employed by him during the progress of the work covered by the Contract.

- J. It is the responsibility of each Trade Contractor to coordinate the various related equipment requirements between their subcontractors, suppliers, and other trade contractors, and to also follow the approved manufacturer's installation instructions.

1.07 OPERATIONAL AND MAINTENANCE INSTRUCTIONS

- A. All operational and maintenance instructions that are provided to various Owner-selected members of the facility engineering and/or maintenance staff are, at the same time presented, to be fully recorded on DVD by the Contractor so that all such sessions can be later reviewed by the Owner's staff on a retraining basis as needed. All such DVDs are to become the property of the Owner at the end of each applicable training period, with one copy of each also being supplied to the A/E for the A/E project files.

PART 2 PRODUCTS

2.01 MANUFACTURERS/PRODUCTS/SUBMITTALS

- A. Under the Base Bid, no other manufacturers except those indicated on the Drawings or those listed within the Sections of this Division, that are, in turn, able to comply with the contract document requirements and minimum standards of these specifications, will be acceptable. In addition to specific required "Alternates," proposed substitutions that may or may not be acceptable to the Owner may be submitted by the Contractor only at the time of initial base bid submittal.
- B. Although design-based models of various manufacturers may be indicated within the various schedules, it is the responsibility of the various equipment manufacturers to verify the model selections so that all items of equipment comply with the minimum standards of performance that are indicated within the schedules, as well as the requirements within various sections of the specifications under which the equipment is also specified.
- C. All submittals shall conform completely to the requirements of the Contract Documents, including all requirements set forth in Division 01 Section "Submittals".
- D. Shop Drawings are to be submitted on each item of specified or scheduled equipment, valves, specialties, insulation, fixtures, drains, controls and related accessories. All control submittals must include a typed sequence of control for each system.

2.02 ACCESS DOORS AND PANELS

- A. Unless otherwise indicated, each Trade Contractor is to locate and furnish all access doors required for non-accessible surfaces (such as ceilings, walls, chases, and similar locations), so that all valves and similar items are easily accessible for operation, inspection and maintenance. Access doors for ceiling, walls, chases, etc. are to be installed by the General Contractor. The Trade Contractor is to bear the costs of the installation of the access doors.
- B. See Section 08 3113 for access door types and specifications. The size of the access doors shall provide proper access for service, routine maintenance, removal and replacement of the product. Minimum size to be 12 inch x 12 inch, or as indicated or required to allow inspection of items served.
- C. LAY-IN CEILING: Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration, provided under Lay-Section 09500, are sufficient to use as access panels no additional access provisions are required unless specifically indicated.
- D. Concealed Spline Ceilings: Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Section 09500.
- E. Plaster Walls and Ceilings: 16-gauge frame with not less than a 20-gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications,

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key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12"

2.03 EXCAVATION AND BACKFILL

- A. See Civil Specifications for all additional requirements.
- B. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.
- C. At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.
- D. Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.
- E. Remove surplus excavated materials from site.
- F. Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.
- G. Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.
- H. Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.
- I. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.
- J. Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.
- K. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

2.04 SHEETING, SHORING AND BRACING

- 1. Provide shoring, sheet piling and bracing in conformance with State and Local codes to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

2.05 DEWATERING

- A. See dewatering requirements in specification 22 05 07, 3.2

2.06 EQUIPMENT NOISE AND VIBRATION

- A. Vibration from equipment shall not be apparent in occupied areas of the building,
- B. Measured sound levels exceeding design criteria is grounds for modification as required to comply with manufacturers recommendations at no additional cost to the Owner.

2.07 BUILDING ACCESS

- A. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

2.08 EQUIPMENT ACCESS

- A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.

2.09 COORDINATION

- A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
- B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

2.10 PIPE SLEEVES

- A. Provide galvanized, schedule 40 pipe sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall neatly around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. Install sleeves for piping passing through penetrations in floors, partitions and walls.
- B. Install vertical sleeves in concrete floors and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth.
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- E. Pipe penetrations in areas subject to public view shall have an escutcheon plate.

2.11 SPACE REQUIREMENTS FOR EQUIPMENT

- A. Equipment has been selected to fit into physical space provided, while allowing room for access, servicing, removal and replacement of parts. Typically allow a minimum of 24" clear space between pieces of equipment.
- B. Since space requirements and equipment arrangements vary according to manufacturer, the responsibility for space and access requirements, is the responsibility of the installing contractor.
- C. Contractor shall provide proper space and access for equipment in accordance with code requirements and the requirements of the local inspection department and the recommendations of the equipment manufacturer.

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- D. Contractor shall verify the size and weight limitations of the space in which it is to be installed and that doors or other building openings are adequate size to permit the entry of the equipment without alterations to the building. The cost of such alterations caused by failure to comply with these instructions shall be borne by the Contractor.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide all materials, labor, equipment, and services necessary for a complete and operable installation as specified and shown on the Drawings. The word "Provide" shall mean "Furnish and install."
- B. Provide new material and equipment in strict accordance with these Specifications and the Project Drawings.
- C. At all times, take such precautions as are necessary to protect materials from damage. Close all pipe openings to prevent obstructions and contamination.

3.02 CUTTING AND PATCHING IN BUILDINGS

- A. Each Contractor is responsible for all costs associated with the necessary cutting and patching as required for the installation of their work, unless otherwise indicated.
- B. Patching is to be performed by the trade proper for each material to be patched. Patching shall leave premises and finishes in a complete and neat condition comparable to the original. Painting of patched surfaces to be by the painting sub-contractor of the General Contractor, unless otherwise specifically indicated or the plumbing/fire protection contractor is the prime contractor for the project. Maintain the fire integrity of all walls, floors, ceilings, and partitions.

3.03 PROTECTION

- A. Protect equipment and trim against damage and injury due to building materials, acid, tools, equipment and any causes incidental to construction. Cover the finished surface of each piece of equipment with building paper or similar protection. Replace all equipment damaged by any cause and any trim with marred or scratched finish at no cost to the Owner, upon receipt of written notification from the A/E.
- B. Where materials to be installed are being stored at or near the project during construction, arrange such materials so as to minimize the possibility of contamination, corrosion and damage. Keep ends of pipe, equipment, and specialties properly closed during construction and installation to avoid the possibility of miscellaneous materials being placed in the openings.

3.04 PAINTING

- A. See Division 09 Section "Interior Painting".

3.05 ADJUST AND CLEAN

- A. Inspect all equipment and put in satisfactory working order.
 - 1. Clean all exposed and concealed items.
 - 2. Clean floor drains, cleanouts, and plumbing fixtures.
 - 3. Clean specialties.
 - 4. Clean all covers.
 - 5. Clean exposed piping.
 - 6. Adjust pumps, balancing valves, and faucets for proper flow rates.
 - 7. Adjust water heaters and thermostatic mixing valves for required temperatures.

END OF SECTION

**SECTION 220502
SELECTIVE DEMOLITION**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Demolish and remove all items required to complete the work indicated.
 - 2. Demolish designated building equipment and fixtures.
 - 3. Demolish designated construction.
 - 4. Cutting and alterations for completion of the Work.
 - 5. Protecting items designated to remain.
 - 6. Removing demolished materials.
 - 7. Cap and identify existing utilities.
 - 8. Provide adequate shoring and bracing.

1.02 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- C. Shop Drawings:
 - 1. Indicate demolition and removal sequence.
 - 2. Indicate location of items designated for reuse or Owner's retention.
 - 3. Indicate location and construction of temporary work.

1.03 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition and subsurface obstructions.
- C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.04 QUALITY ASSURANCE

- A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.
- B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.

1.05 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.06 SCHEDULING

- A. Section 01 32 16 - Network Analysis Schedules: Requirements for scheduling.
- B. Schedule Work to coincide with new construction.
- C. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owner's operation and in adjoining spaces.
- D. Perform noisy or dusty work as scheduled with the Owner.
- E. Coordinate utility and building service interruptions with Owner.
 - 1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.

3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.07 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 - EXECUTION

2.01 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.
- D. Erect and maintain weatherproof closures for exterior openings.
- E. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- F. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- G. Provide appropriate temporary signage including signage for exit or building egress.
- H. Do not close or obstruct building egress path.
- I. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

2.02 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.
- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

2.03 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.
- C. Do not close or obstruct roadways or sidewalks without permits.
- D. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer.
- E. Disconnect and remove designated utilities within demolition areas.

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- F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
- G. Demolish in orderly and careful manner. Protect existing improvements and supporting structural members.
- H. Carefully remove building components indicated to be reused.
 - 1. Disassemble components as required to permit removal.
 - 2. Package small and loose parts to avoid loss.
 - 3. Mark components and packaged parts to permit reinstallation.
 - 4. Store components, protected from construction operations, until reinstalled.
- I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- K. Remove temporary Work.

END OF SECTION

**SECTION 220507
EXCAVATION AND BACKFILL**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 1, General Requirements.

1.02 DESCRIPTION OF WORK

- A. Each Trade Contractor is to provide all excavating, trenching, sheeting, bracing, pumping, and backfilling as required for the installation of his work.

1.03 QUALITY ASSURANCE

- A. Testing
1. All testing is to be done by an independent testing laboratory employed by this Contractor and approved by the Owner and A/E.
 2. Conduct up to 10 tests per Trade per 40,000 gross square foot of compacted surface serving each Trade's specific area of work to determine the compaction density of backfill.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- H. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- I. Impervious Fill: Clay gravel and sand mixture capable of compacting to a dense state.

2.02 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Yellow: Gas, oil, and dangerous materials.
 2. Blue: Water systems.
 3. Green: Sewer systems.

PART 3 EXECUTION

3.01 GENERAL

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering interior of building 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.
 - 2. If necessary, install a temporary submersible pump and basin to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXCAVATION, GENERAL

- A. Rock 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.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction.
 - 3. Earth excavation includes excavating visible rocks on surface and below surfaces. Intermittent drilling, ram hammering or ripping of material shall be included with the contractor's project bid.
 - 4. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.
 - 5. Pipe trench widths to provide the following clearance on each side of pipe. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe, unless otherwise indicated. Clearance: 12 inches each side of pipe.
 - 6. Trench Bottom Excavate trenches 6 inches deeper than bottom of pipe elevation to allow for bedding course.

3.04 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, sub-drainage, damp-proofing, 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.

3.05 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.

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- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
- D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling and compaction at each 6" layer.
- F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.06 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under steps and ramps, use engineered fill.
 - 2. Under building slabs, use engineered fill.
 - 3. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.07 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.

3.08 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches 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 and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.09 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.

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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.

3.10 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by A/E; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

**SECTION 220508
PIPING EXPANSION COMPENSATION**

PART 1 – GENERAL

1.01 SUMMARY:

Note: Contractor shall furnish and install necessary seismic isolation, bracing and supports in accordance with Zone “D” Rating.

- A. Section includes:
 - 1. Flexible pipe connectors.
 - 2. Expansion joints.
 - 3. Expansion compensators.
 - 4. Pipe alignment guides.
 - 5. Swivel joints.
 - 6. Pipe anchors.
- B. Related Sections:
 - 1. Section 13910 – Basic Fire Suppression Materials and Methods: Products and installation requirements for piping used in fire protection systems.
 - 2. Section 15060 – Hangers and Supports: Product and installation requirements for piping hangers and supports.
 - 3. Section 15070 – Mechanical Sound, Vibration, Seismic Control: Product and installation requirements for vibration isolators used in piping systems.
 - 4. Section 15140 – Domestic Water Piping: Product and installation requirements for piping used in domestic water systems.
 - 5. Section 15180 – Heating and Cooling Piping: Product and installation requirements for piping used in heating and cooling systems.

1.02 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B31.1 – Power Piping.
 - 2. ASME B31.5 – Refrigeration Piping.
 - 3. ASME B31.9 – Building Services Piping.
- B. American Welding Society:
 - 1. AWS D1.1 – Structural Welding Code – Steel.

1.03 DESIGN REQUIREMENTS

- A. Provide structural work and equipment required for expansion and contraction of piping.
- B. Expansion Compensation Design Criteria:
 - 1. Installation Temperature: 50 degrees F.
 - 2. Hot Water Heating System Temperature: 210 degrees F.
 - 3. Domestic Hot Water: 140 degrees F.
 - 4. Safety Factor: 30 percent.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Manufacturer’s Installation Instructions: Submit special procedures.

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- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: indicate results of inspection by manufacturer's representative.

1.05 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors and guides.
- B. Operation and Maintenance Data: Submit adjustment instructions.

1.06 QUALITY ASSURANCE

- A. PERFORM Work in accordance with ASME b31.9 code for installation of piping systems.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 – Product Requirements: Product storage and handling requirements.
- B. Accept expansion joints on site in factory packing with shipping bars in positioning devices intact. Inspect for damage.
- C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

PART 2 - PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS

- A. Steel Piping:
 - 1. Inner Hose: Stainless Steel.
 - 2. Exterior Sleeve: Double braided stainless steel.
 - 3. Pressure Rating: 125 psig WSP and 450 degrees F.
 - 4. Joint: As specified for pipe joints.
 - 5. Size: Use pipe-sized units.
 - 6. Maximum offset: 2/4 inch on each side of installed center line.
- B. Copper Piping:
 - 1. Inner Hose: Bronze
 - 2. Exterior Sleeve: Braided Bronze.
 - 3. Pressure Rating: 125 psig WSP and 450 degrees F.
 - 4. Joint: As specified for pipe joints.
 - 5. Size: Use pipe sized units.
 - 6. Maximum offset: 3/4 inch on each side of installed center line.

2.02 EXPANSION JOINTS

- A. Stainless Steel Bellows Type:
 - 1. Pressure Rating: 125 psig WSP and 400 degrees F.
 - 2. Maximum Compression: 1 2/4 inch.
 - 3. Maximum Extension: 1/4 inch.
 - 4. Joint: As specified for pipe joints.
 - 5. Size: Use pipe sized units.
 - 6. Application: Steel piping 3 inch and smaller.
- B. External Ring Controlled Stainless Steel Bellows Type:
 - 1. Pressure Rating: 125 psig WSP and 400 degrees F.
 - 2. Maximum Compression: 15/16 inch.
 - 3. Maximum Extension: 5/16 inch.

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4. Maximum Offset: 1/8 inch.
 5. Joint: Flanged.
 6. Size: Use pipe sized units.
 7. Accessories: internal flow liner.
 8. Applications: Steel piping 3 inch and larger.
- C. Double Sphere, Flexible Compensators:
1. Body: Neoprene and nylon.
 2. Working Pressure: 150 psi.
 3. Maximum Temperature: 250 degrees F.
 4. Maximum Compression: $\frac{3}{4}$ inch 1 inch.
 5. Maximum Elongation: $\frac{1}{2}$ inch.
 6. Maximum Offset: $\frac{1}{2}$ inch
 7. Maximum Angular Movement: 30 degrees.
 8. Joint: Tapped steel flanges.
 9. Size: Use pipe sized units.
 10. Accessories: Control rods.
 11. Application; Steel piping 2 inch and larger.
- D. Two-ply Bronze Bellows Type:
1. Construction: Bronze with anti-torque device, limit stops, internal guides.
 2. Pressure Rating: 125 psig WSP and 400 degrees F.
 3. Maximum Compression: 1 $\frac{3}{4}$ inch.
 4. Maximum Extension: $\frac{1}{4}$ inch.
 5. Joint: As specified for pipe joints.
 6. Size: Use pipe sized units.
 7. Application: Copper piping.
- E. Low Pressure Compensators with two-ply Bronze Bellows:
1. Working Pressure: 75 psig.
 2. Maximum Temperatures: 250 degrees F.
 3. Maximum Compression: $\frac{1}{2}$ inch.
 4. Maximum Extension: 5/32 inch.
 5. Joint: Soldered.
 6. Size: Use pipe sized units.
 7. Application: Copper or steel piping 2 inch and smaller.
- F. Copper with Packed Sliding Sleeve:
1. Maximum Temperature: 250 degrees F.
 2. Joint: As specified for pipe joints.
 3. Size: Use pipe sized units.
 4. Copper or steel piping 2 inches and larger.
 5. Application: Copper or steel piping 2 inch and larger.

2.03 ACCESSORIES

- A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install Work in accordance with ASME B31.1, ASME B31.5, or ASME B31.9.
- B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 15070. Provide line size flexible connectors.

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- C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.
- E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 15060 for pipe hanger installation requirements.
- F. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

3.02 MANUFACTURER'S FIELD SERVICE

- A. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

**SECTION 220513
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

PART 2 PRODUCTS

2.01 EQUIPMENT MOTORS

- A. Motors shall be of sufficient size for the duty to be performed and shall not exceed the motor's full-rated load when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. Motors shall be established, U.S.-manufactured industry standard types for the service intended, having normal starting torque and low starting current characteristics, unless other characteristics are specified. When electrically driven equipment is furnished which materially differs from the contemplated design, the Contractor supplying the driving equipment shall pay for and make necessary the adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed. Motors and equipment shall meet ASHRAE 90-75, and State and Local Energy Code minimum COP requirements. Provide suitable overload protection for each motor.
- B. Unless otherwise specified or noted on the Drawings, motors shall be suitable for the service intended, shall be of latest industry standards of design for maximum energy efficiency, and shall be continuous-duty-type.
- C. Motors less than 3/4 HP shall normally be 120-volt, 1-phase, 60-HZ.
- D. Coordinate and verify voltage and phase required with Electrical Drawings, as well as equipment scheduled data.
- E. It shall be the responsibility of this contractor to coordinate and verify the applicable phase and voltage requirements with the electrical contractor before submittal of Shop Drawings.

2.02 MOTOR CONTROLLERS AND DISCONNECTS

- A. Except as otherwise specified in each of the various sections of Division 22, motor controllers and disconnects shall be as specified under Divisions 26, 27 and 28.
- B. Verify applicable voltage, phase, and protective device requirements with electrical contractor before manufacture or installation of equipment.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall comply with manufacturer's latest published instructions and all applicable inspection and code authority requirements.

3.02 MOTOR EFFICIENCIES

- A. Drip-Proof Motors

	3600 RPM		1800 RPM
HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT	HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT
1-1/2	81.0	1	84.0
2	84.0	1-1/2	84.0

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3	86.0	2	84.0
5	87.0	3	88.0
7-1/2	87.0	5	88.0

B. Totally Enclosed, Fan-Cooled Motors

	3600 RPM		1800 RPM
HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT	HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT
1-1/2	81.0	1	81.0
2	84.0	1-1/2	84.0
3	84.0	2	82.0
5	86.0	3	82.0
7-1/2	88.0	5	85.0

END OF SECTION

**SECTION 220519
METERS AND GAUGES**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 SUMMARY

- A. This Section the includes the following types of meters and gauges: Temperature gauges and fittings. Pressure gauges and fittings.
- B. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 specifications.

1.03 QUALITY ASSURANCE

- A. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.
- B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.04 SUBMITTALS

- A. Shop Drawings: Each equipment and material item specified.
- B. Product Data: Product data for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.
- C. Samples: Not required for review.
- D. Contract Close-Out Information: Maintenance data for each type of meter and gauge in each building for inclusion in Operating and Maintenance Manuals specified in Division 01, and Division 22. Portable test plug test kit and portable meter receipts as described in this Section.

PART 2 PRODUCTS

2.01 THERMOMETERS, GENERAL

- A. Accuracy: Plus or minus 1% of range span or plus or minus one scale division to maximum of 1.5% of range span. Scale Range: Temperature ranges for services listed as follows: Domestic Hot Water: 30 deg to 240 deg with 2 deg scale divisions (0 deg to 115deg C with 1 deg scale divisions). Domestic Cold Water: 0 deg to 100 deg F with 2 deg scale divisions (minus 18 deg to 38 deg C with 1 deg scale divisions).

2.02 THERMOMETERS

- A. Weiss Model DVU35 digital self powered, glass passivated thermistor, internal potentiometer with 6" stem. Thermometer wells to be brass or stainless steel, 2" extension in insulated piping. Provided threaded cap nut and cap.
- B. Manufacturers: Weiss, Ashcroft, Weksler, Terrice, Miljoco, or Marshalltown.

2.03 DIAL-TYPE INSERTION THERMOMETERS

- A. Type: Bimetal stainless steel case and stem, 1-inch diameter dial, dust and leakproof, 1/8-inch diameter tapered-end stem with nominal length of 5 inches.
- B. Manufacturers: Ashcroft Dresser Industries/Instrument Div., Terrice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.04 SOLAR DIGITAL THERMOMETERS

- A. Type: Bi-directional digital display, high impact ABS black plastic case.
 - 1. Stem 3-1/2" zinc.
 - 2. Range: -58 deg. to 302 deg.F

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B. Manufacturers: Weksler.

2.05 THERMOMETER WELLS

- A. Brass or stainless steel, pressure-rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.
- B. Manufacturers: Marshalltown Instruments, Inc., Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.06 PRESSURE GAUGES

- A. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube-type, bottom connection.
- B. Case: Drawn steel or brass, glass lens, 4-1/2-inch diameter.
- C. Connector: Brass, 1/4-inch NPS.
- D. Scale: White coated aluminum, with permanently etched markings.
- E. Accuracy: Plus or minus 1% of range span.
- F. Range: Conform to the following: Vacuum: 30 inch Hg to 15 psi, All fluids: 2 times operating pressure
- G. Manufacturers: Ametek, U.S. Gauge Div., Ashcroft Dresser Industries/Instrument Div., Marsh Instrument Co., Unit of General Signal, Marshalltown Instruments, Inc., Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.07 PRESSURE GAUGE ACCESSORIES

- A. Siphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.
- B. Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.
- C. Manufacturers: Ametek, U.S. Gauge Div., Ashcroft Dresser Industries/Instrument Div., Marsh Instrument Co., Unit of General Signal, Marshalltown Instruments, Inc., Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.08 TEST PLUGS

- A. Test plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and two self-sealing valve-type core inserts suitable for inserting a 1/8 inch O.D. probe assembly from a dial-type thermometer or pressure gauge. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.
- B. Core Material: Conform to the following for fluid and temperature range: Air, Water, Oil, and Gas, 20 deg to 200 deg F (minus 7 deg to 93 deg C): Neoprene, Air and Water, minus 30 deg to 275 deg F (minus 35 deg to 136 deg C): EPDM
- C. Ranges of pressure gauge and thermometers shall be approximately two times systems operating conditions.
- D. Manufacturers: MG Piping Products Co., Peterson Equipment Co., Inc., Sisco, A Spedco, Inc. Co., Trerice (H.O.) Co., Watts Regulator Co., Flow Design, Inc.

PART 3 EXECUTION

3.01 THERMOMETER INSTALLATION

- A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.
- B. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

3.02 INSTALLATION OF PRESSURE GAUGES

- A. Install pressure gauges in piping tee with pressure gauge valve, located on pipe at most legible position.
- B. Pressure Gauge Needle Valves: Install in piping tee with snubber. Install siphon in lieu of snubber for steam pressure gauges.
- C. Install pressure gauges on the inlet side and outlet side of all Backflow Preventers.

3.03 INSTALLATION OF TEST PLUGS

- A. Test Plugs: Install in piping tee where indicated, located on pipe at most legible position. Secure cap. Install test plugs adjacent to each piping point where a temperature sensing device is required by control specifications.
- B. Test Kit: Provide test kit consisting of one pressure gauge, gauge adapter with probe, two bimetal dial thermometers, and carrying case. Turn over to Owner at completion of job and obtain written receipt. Forward copy of receipt to A/E as part of close-out documents.

3.04 ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.
- B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.05 CONNECTIONS

- A. Piping installation requirements are specified in other sections of Division 22. The drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
- B. Install meters and gauges to allow for easy visual observation.

END OF SECTION

**SECTION 220523
DUTY VALVES**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 QUALITY ASSURANCE

- A. Valve Bodies, Shells and Seats: Factory-tested.
- B. Standard for 125 psi and 150 psi saturated steam rated valve pressure containing parts: ASTM B62.
- C. Standard for 200 psi and 300 psi valves with metallic seats: ASTM B61.
- D. Iron Body Valves: Pressure-Containing Parts: ASTM A126, Grade B, Face-to-Face and End-to-End Dimensions: ANSI B16.10, Design, Workmanship, Materials, Testing: MSS-SP-70, 71, Use domestically manufactured valves where required by a Buy American Plan.
- E. Butterfly Valves: Face-to-Face and End-to-End Dimensions: MSS-SP-67.
- F. Valve Stems: ASTM B371, Alloy C69400; ASTM B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.
- G. Pressure Castings: Free of impregnating materials.
- H. Manufacturer's name or trademark and working pressure stamped or cast into body.

1.03 SUBMITTALS

- A. Shop Drawings: Schedule indicating proposed valve for each application.
- B. Product Data: Manufacturer's cut sheets and/or literature, Performance data.
- C. Samples: Not required for review.
- D. Reference Submittals: Not required for review.
- E. Contract Closeout Information: Valve chart indicating valve identification number, valve type, service, manufacturer and model number, and location of valve, Operating and maintenance manuals.

1.04 JOB CONDITIONS

- A. Coordinate the exact application and location of this work with the work of other trades prior to installation within various piping systems. Verify all positions and elevations. Provide additional offsets and section of piping as required to position valves for equipment clearance and accessibility as well as system and valve operational conditions.
- B. Valve manufacturer to verify indicated figure or model numbers so that selection meets required description and conditions specified. Specified data for valve shall take precedence over indicated figure or model number. Provide proper seat and seal material for applicable temperature, pressure and service indicated for each valve application.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Gate, Butterfly, Check & Ball Valves: Jomar, Nibco, Hammond, Crane, Jenkins, Milwaukee, Apollo, Mueller.

2.02 DOMESTIC WATER VALVES

- A. For gauge valves within steel or copper lines of 1/8 inch or 1/4 inch size, threaded or solder, 150 psig steam or 300 psig w.o.g., union bonnet, integral seat, renewable seat and disc, bronze globe valve conforming to MSS-SP-80, ASTM B-62.

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- B. For service valves within steel piping of 1/4 inch through 2 inch size; two-piece ball valve with bronze solder ends, lever handle, stainless steel ball and stem, Class 150 SWP-600 w.o.g.
- C. For check valves within horizontal steel or copper lines through 2 inch size, bronze check valve with teflon disc, threaded ends, Class 150 swp-300 w.o.g., as follows:

	Part	Specifications
1.	Body	Bronze, ASTM B62
2.	Cap	Bronze, ASTM B62
3.	Lever	Bronze, Commercial
4.	Disc	Teflon
5.	Disc Holder	Brass, ASTM B16 1/4 inch & 1/2 inch Bronze, ASTM B62 3/4 inch to 2 inch included
		Bronze, ASTM B62 3/4 inch to 2 inch included
6.	Pin	Stainless Steel, Commercial
7.	Plug	Bronze, ASTM B16
8.	Retaining Ring	Stainless Steel, Commercial
9.	Disc Nut	Bronze, Commercial

- D. Optional check valves for vertical type of installation within steel or copper lines, similar to that of above sub-paragraph G, except vertical lift up-flow, bronze with threaded ends.
- E. Hot Water Return – Balancing Valves: B&G Circuit Setter-Plus. Leadfree construction, brass valve body with stainless steel ball. Install along with line size check valve. Manufacturers: B&G, Taco, Armstrong, Nexus.
- F. Flow Rates For Valve Sizing:
 - 1. * flow = 0.5 – 2-0 gpm use Circuit Setter-Plus Model CB-1/2”S-LF
 - 2. * flow = 3.0 - 5.0 gpm use Circuit Setter-Plus Model CB-3/4”S-LF
 - 3. * flow = 6.0 - 10.0 gpm use Circuit Setter-Plus Model CB-1”S-LF
 - 4. * flow = 11.0 - 15.0 gpm use Circuit Setter-Plus Model CB-1-1/4”S-LF

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall be in accordance with manufacturer's written instructions, and all valves must be suitable for the service intended.
- B. Provide service (isolation) valve at every piece of equipment. Service valves to be positioned in a manner to allow for ease of service and removal of equipment with minimum disruption of the piping system.
- C. All shut-off valves in plumbing water systems 2 inch and smaller shall be ball-type.

END OF SECTION

**SECTION 220529
HANGERS AND SUPPORTS**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

- A. Work of this Section includes, but is not limited to: Pipe hanger and supports, Pipe and equipment anchors, Pipe sleeves.

1.03 QUALITY ASSURANCE

- A. Pipe Hanger Standards: Manufacturers Standardization Society (MSS) SP-58, SP-89, and SP-69, as referenced.
- B. SMACNA.
- C. NFPA

1.04 SUBMITTALS

- A. Shop Drawings: Miscellaneous steel layout. Indicate all point loads where miscellaneous steel is supported by structural members, Brace spacing, layout, connection method and details.
- B. Product Data: Catalog cuts and performance data.
- C. Samples: Not required for review.
- D. Reference Submittals: Not required for review.
- E. Contract Closeout Information: Operating and maintenance data, Warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Pipe Hangers: Elcen Metal Products Co., B-Line Systems Inc., Carpenter and Paterson Inc., Anvil.
- B. Concrete Anchors: Phillips, Hilti.
- C. Insulated Pipe Supports: Pipe Shields Inc., Anvil, Power Piping.
- D. Pipe and Equipment Anchors: Shop-fabricated, Field-fabricated.
- E. Sleeves: Shamrock Industries, "Crete-sleeve" plastic hole forms, Proset Systems Inc., "Proset" fire-safe pipe penetrations, Shop for field fabricated.
- F. Sleeves, Pre-Manufactured Fire and Smoke Wall Barrier: Pipe Shields, Inc.
- G. Roof Piping Supports: Miro, Dura-Blok

2.02 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Cadmium plated carbon steel, adjustable swivel split ring. Use PVC coated or copper plated for copper piping.
- B. Hangers for Pipe Sizes 2 and Over: Carbon steel, adjustable, clevis type. Use copper plated for copper piping.
- C. Hangers for piping that gets insulated shall be sized to allow insulation to be continuous through hangers.
- D. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- E. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.
- F. Vertical Support: Steel riser clamp.

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- G. Floor Support for Pipe Sizes to 8 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- H. Shield for Insulated Piping 2 Inches and Smaller: 18 gage galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.
- I. Shields for insulated piping 2 1/2 inches and larger shall be waterproof hydrous calcium silicate, encased in 360o galvanized steel shield.
- J. Roof Piping Supports shall be pre-manufactured devices. Wood block supports will not be acceptable.

2.03 HANGER RODS AND ATTACHMENTS

- A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded. Use cadmium plated rods where unconcealed or exposed to the elements.
- B. Minimum pipe hanger rod sizes are as follows:

Pipe Size	Rod Diameter
Up to 2 Inches	3/8 Inch
2-1/2 Inches & 3 Inches	1/2 Inch
4 Inches	5/8 Inch
6 Inches	3/4 Inch
8 Inches to 12 Inches	7/8 Inch

- C. Beam Clamps (up to 8-inch diameter pipe): Top beam clamp, steel jaw, hook rod with nut and spring washer steel eye-bolt. C-clamps by themselves are expressly prohibited unless otherwise approved by Structural Engineer

2.04 INSERTS

- A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.05 PIPE SLEEVES AND SEALANTS

- A. Sleeves – General: Sleeve all piping passing through walls, floors, roofs, foundations, footings and grade beams sufficient to allow free movement of piping. Box out openings larger than 14 inch diameter.
- B. Sleeves, Steel Pipes: Use in following locations:
 - 1. Fire-rated and smoke-rated construction.
 - 2. Structural steel members (when approved by A/E).
 - 3. Floors: Galvanized.
 - 4. Concrete walls.
 - 5. Mechanical rooms, tunnels, and stairwells.
 - 6. Polyethylene hole forms (Crete-Sleeve): Optional use in poured concrete walls and floors.

- C. Sleeves for Plastic Piping
 - 1. Provide pipe sleeves for all plastic-type piping (PVC, CPVC and polypropylene) at fire-rated assembly and floor slab penetrations.
 - 2. Size sleeves per following schedule:

Pipe Size (In.)	Sleeve Size (In.)	Extension Beyond Barrier (Ft.)
1 or less	3	2
1-1/4 to 2	4	2
3	5	3
4	6	4

- 3. Extend sleeve listed distance beyond wall or floor on both sides.

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4. Insulate plastic pipe with minimum 1 inch thick calcium silicate or 2400 deg F aluminasilica within sleeve length.
- D. Sleeves, pre-manufactured fire and smoke wall barrier: Optional, similar to Pipe Shields, Inc.
 1. Bare Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
 2. Insulated Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
 - a. Insulated chilled water and DX lines: Type CS-CW.
 - b. Other insulated pipes: Type CS.
 3. Plastic Pipe through Fire Walls and Floors: Type WFB with 1-inch-thick calcium silicate insulation encased in metal sleeve extension 2 ft. either side of fire-rated walls or floor.
- E. Sleeve Sizes
 1. Length: Ends flush with finished surfaces.
 2. Diameter
 - a. Minimum 3 inch.
 - b. Minimum 1 inch larger than pipe and pipe insulation.
 - c. In concrete, 1-1/2 inch larger than pipe.
 - d. Diameter suitable for construction tolerances and to receive sealant, when indicated.
- F. Sealants: Seal annular space around piping.
 1. For fire- and smoke-rated floors, walls and partitions: Use UL-listed firestopping material that maintains fire-rated wall and floor integrity. Provide proper material for each typical application as described by manufacturer.
 2. Acceptable Manufacturers: Dow Corning "Fire Stop", Nelson "Flameseal", 3M "Fire Barrier", Pipe Shields Inc., Model WFB, DFB, or QDFB Series, Proset Systems.
 3. For Non-Rated Walls and Partitions: Use mineral or glass fiber insulation.
 4. For Exterior and Foundation Walls: Use synthetic rubber seals, "Link-Seal" waterproof material or system.

PART 3 EXECUTION

3.01 GENERAL

- A. Structural Considerations
 1. Steel or concrete roof/floor system, including slabs or roof deck shall be in place and complete before installation of any mechanical piping system.
 2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe Hanger Loading."
 3. Do not attach hangers to steel roof deck.
 4. Do not attach hangers to bottom of concrete filled floor deck, except by permission of A/E.
 5. Attach hangers to beams whenever possible.
- B. Install piping systems with approved hangers and supports to prevent sagging, warping and vibration of piping systems. Install pipe hangers and supports to allow for expansion, contraction, and drainage of piping. Place hangers and supports close to valves, vertical riser drops, heavy equipment, specialties, and each piping change of direction.
- C. Connect hanger rods to approved "I" beams or channel clamps, concrete inserts or expansion shields. Provide all concrete inserts and structural members required for the proper support of the piping systems with proper approved distribution of weight.
- D. Do not weld to structural steel without special permission of the A/E. Do not use wooden plugs for any form of fastening.
- E. Space pipe hangers for horizontal piping as indicated, unless otherwise directed. Provide pipe hangers with the minimum rod sizes shown, complete with full length machined threads, and adjusting and lock nuts.
- F. Run piping substantially as shown on the Drawings. Run pipe as directly as possible, avoiding unnecessary offsets and interferences, maintaining maximum headroom and concealed in all rooms or areas, except mechanical equipment rooms, unless otherwise noted. Coordinate

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exact locations of mains, risers and runouts in the field with the various Trade Contractors and the A/E.

- G. Arrange pipe lines to give ample room for pipe insulation. Run piping parallel to or at right angles with the lines of the building.
- H. Assemble and install piping without undue strain and stress and with provision for expansion, contraction and structural settlement. Do not cut or notch structural members unless adequate provision is made with the approval of the A/E. Anchors shall be approved by the A/E before they are used.

3.02 PIPE HANGERS AND SUPPORTS

- A. For standard steel and copper piping, locate hangers at each change of direction as well as within remaining lengths spaced at or within following maximum limits:

Pipe Diameter	Standard Liquid	Steel Vapor	Copper Liquid	Copper Vapor
1/2 - 1 inch	7 ft.	8 ft.	5 ft.	6 ft.
1-1/4 - 2 inch	7 ft.	9 ft.	7 ft.	9 ft.
2-1/2 - 3 inch	11 ft.	14 ft.	9 ft.	13 ft.
3-1/2 - 4 inch	13 ft.	16 ft.	11 ft.	15 ft.
5 - 6 inch	16 ft.	19 ft.	13 ft.	18 ft.
8 - 14 inch	16 ft.	24 ft.	16 ft.	16 ft.
	16 in		20 ft.	24 ft.

- B. For Schedule 40 or Schedule 80 PVC piping, locate hangers at each change of direction and space at or within the following maximum limits:

Schedule 40 or 80 PVC

Pipe Diameter	Liquid	Vapor
1/2 - 1 inch	3 Ft.	3 Ft.
1-1/4 - 2 inch	3 Ft.	3 Ft.
2-1/2 - 3 inch	6 Ft.	6 Ft.
3-1/2 - 4 inch	7 Ft.	7 Ft.
5 - 6 inch	8 Ft.	8 Ft.
8 - 14 inch	12 Ft.	12 Ft.

- C. Provide a hanger within one (1) foot or less of each horizontal elbow and valves that are above three (3) inches in size. If spacing between horizontal elbows (or plugged tees used as elbows) is less than six (6) feet, provide only one (1) hanger located between the elbows. No hanger size or requirements shall ever be less than the minimum recommended by the Mechanical Contractor's Association of America, Inc.
- D. For cast iron pressure piping, space maximum 12 feet o.c. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
- E. For cast iron soil piping, space maximum 10 feet o.c. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
- F. For piping of other materials, space hangers according to manufacturer's recommendations.
- G. Pipe Hanger Loading
 - 1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 inch	610 lb.
1/2 inch	1,130 lb.
5/8 inch	1,810 lb.

3/4 inch

2,710 lb.

2. Do not exceed manufacturer's recommended maximum safe load if smaller than above.
- H. Trapeze Hangers: Suspend trapeze hangers from concrete inserts of approved structural clips. Construct trapeze hangers of galvanized angle iron, channels or other structural shapes with flat surfaces for point of support.
- I. Vertical Pipe Supports: Support all vertical pipe runs in pipe chases at base of riser. Support pipes for lateral movement with clamps or brackets.
- J. Concrete Inserts: Provide individual or continuous slot concrete inserts for use with hangers for piping and equipment exposed in finished areas, and as required. Provide concrete inserts in time for installation in concrete.

3.03 ANCHORS

- A. All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase.
- B. Pipe Anchors: Provide as indicated and required to permit complete installation of system. Do not anchor piping to plaster or gypsum wallboard partition walls. Provide anchoring devices at locations indicated. Do not use powder driven fasteners, expansion nails, or friction spring clamps.

3.04 MISCELLANEOUS STEEL

- A. Piping Contractor (or Plumbing Contractor, as applicable) to provide all miscellaneous steel as required to accommodate pipe supports and hangers.
- B. Provide Shop Drawings detailing miscellaneous steel layout and connection to structural members. Indicate all point loads where miscellaneous steel is supported by structural members.
- C. All miscellaneous steel to be galvanized steel. Repair galvanized steel at field cuts and connections.

END OF SECTION

**SECTION 220553
PIPE AND EQUIPMENT IDENTIFICATION**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

- A. Work of this Section includes, but is not limited to: Piping identification, Valve identification, Equipment identification.

1.03 QUALITY ASSURANCE

- A. Piping System Identification: ANSI A13.1-1981, "Scheme for the Identification of Piping Systems."

1.04 SUBMITTALS

- A. Shop Drawings: Not required for review.
- B. Product Data: Manufacturer's cut sheets and/or literature.
- C. Samples: Not required for review.
- D. Reference Submittals: Not required for review.
- E. Contract Closeout Information: Valve chart showing valve numbers, type, and location.

PART 2 PRODUCTS

2.01 PIPE MARKERS

- A. Conform to ANSI A13.1-81.
 - 1. Pressure-sensitive vinyl (self-sticking) material.
 - 2. Mechanically Fastened Type: Snap-on or strap-on. For dirty greasy, oily pipe where pressure-sensitive markers may not perform satisfactorily.
 - 3. Provide with direction of flow arrows.
 - 4. Size of Letters Legend

Outside Diameter of Pipe or Pipe Covering	Length of Color Field	Size of Letters and Arrows
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
8 to 10 inch	24 inch	2-1/2 inch
Over 10 inch	32 inch	3-1/2 inch

2.02 VALVE TAGS

- A. Brass or Anodized Aluminum Type
 - 1. Brass: Minimum 19 ga, polished, 1-1/2-inch diameter with following lettering:
 - a. Service: 1/4 inch stamped black filled letters.
 - b. Valve numbers: 1/2 inch stamped black filled letters.
 - 2. Aluminum: 2-inch diameter, 0.032 inch thick, with following lettering:
 - a. Service: 1/4-inch engraved letters.
 - b. Valve numbers: 1/2-inch engraved letters.
- B. Valve Tag Fasteners: 4-ply 0.018 copper or monel wire meter seals, brass "S" hooks or No. 16 brass jack chain.

2.03 EQUIPMENT NAME PLATES

- A. 1/16-inch rigid plastic "Setonply," "Emedolite," or bakelite with 4 edges beveled, or engraved aluminum with black enamel background and natural aluminum border and letters.
 - 1. Two 3/8-inch mounting holes.
 - 2. Lettering size: Minimum 1/2-inch high.
 - 3. Fasteners: Commercial quality, rust-resisting nuts and bolts with backwashers and self-tapping screws or rivets.

2.04 CHART AND DIAGRAM FRAMES

- A. Extruded aluminum with plexiglass or glass windows.

2.05 ACCEPTABLE MANUFACTURERS

- A. Pipe, Valve, and Equipment Markers: Craftmark Identification Systems, W. H. Brady Co, EMED Company, Inc., Kolbi Industries, Inc., 3M Co., Seton Name Plate Corp.

PART 3 EXECUTION

3.01 VALVE AND EQUIPMENT IDENTIFICATION

- A. Designate all equipment and valves by distinguishing numbers and letters on charts and/or diagrams. Tag and locate following equipment items: Valves, All items indicated on drawing equipment schedules.
- B. Install tags on all devices with numbers and letters corresponding to charts.
- C. Fasten tags securely to devices with tag fasteners in manner for easy reading.
- D. Attach equipment nameplates in conspicuous location on item of equipment or apparatus such as starters, pumps, and control panels. Secure nameplates with self-tapping screws, or nuts and bolts.
- E. For unsuitable conditions, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.
- F. Furnish 4 charts including device number, location (room number, department) and purpose. Mount 1 chart in frame and secure on wall in location directed by Owner. Include remaining 3 sets in "Operation and Maintenance Manuals."
- G. Provide all devices located above ceilings with additional identification. Use access panel markers (metal-tack-style) for acoustical tile ceilings, or engraved plastic style, 3/4 inch square, for mounting on panel door. Coordinate with Owner on identification method and color codes.

3.02 PIPE IDENTIFICATION

- A. Soil, waste, and vent piping do not require color coded paint or bands.
- B. Locate pipe markers as follows:
 - 1. Next to each valve and fitting, except on plumbing fixtures and equipment.
 - 2. At each branch or riser take-off.
 - 3. At each passage through walls, floors, and ceilings.
 - 4. At each pipe passage to underground.
 - 5. On all horizontal pipe runs every 20 ft., at least once in each room and each story traversed by piping system.
 - 6. Identify piping contents, flow direction, supply and return.
- C. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.
- D. Where supplementary color identification of medical gas piping is used, paint in accordance with gases and colors indicated in CGA Pamphlet C-9.

3.03 SERVICE ABBREVIATIONS

- A. General
 - 1. CW Domestic Cold Water

RQAW Corporation

Wheatland Wastewater

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2. HW () Domestic Hot Water Supply (indicate temperature)
3. HWC Domestic Hot Water Circulating
4. P Discharge Plumbing-Sump Pump/Sewage Ejector
5. G Natural Gas

END OF SECTION

**SECTION 220561
PREPARATION OF PLUMBING SYSTEMS**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEANING AND PREPARATION FOR SERVICE

- A. Flushing Mains. Immediately upon completion of the water distribution system, test valves to ensure their full opening. Flush the system as follows: Open valve and permit the flow to continue until the water runs clear. Repeat the operation at the next valve and proceed in order to the valve farthest from the source of supply. Use outlets in building to flush the upper ends of mains and service lines. During such flushing operation, the A/E may test the flows from valves and, before final acceptance of the work, make further tests of flows to ascertain that lines are clear.
- B. Interior and Exterior Sterilization of Water Distribution System. After the water distribution system has been flushed, sterilize the system by the following or other, more rigid methods satisfactory to the A/E and the State and Local Plumbing Authorities.
1. Introduce chlorine or a solution of calcium or sodium hypochlorite, filling the lines slowly and applying the sterilizing agent at a rate of 50 parts per million of chlorine, as determined by residual chlorine tests at the ends of the lines. Open and close all valves and hydrants while chlorinating the system.
 2. After sterilization agent has been applied for 24 hours, test for residual chlorine at the ends of the lines. If less than 25 ppm is indicated, repeat the sterilization process.
 3. When tests show at least 25 ppm of residual chlorine, flush the system until all traces of the chemical are removed.
- C. The Owner reserves the right to require testing of the water again at any time prior to final acceptance of the work and, if found bacteriologically unsafe, to require the Contractor to re-chlorinate the system until the water is proven equal to that supplied by the public system.

3.02 SANITARY WASTE/VENT AND STORM DRAINAGE SYSTEMS

- A. Test systems as recommended by Local and State Plumbing Inspection Authorities.

3.03 OPERATIONAL TEST

- A. Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:
1. Time, date, and duration of test.
 2. Water pressure at the most remote and the highest fixtures.
 3. Operation of each fixture and fixture trim.
 4. Operation of each valve, hydrant, and faucet.
 5. Pump suction and discharge pressures.
 6. Temperature of each domestic hot water supply.
 7. Operation of each floor and roof drain by flooding with water.
 8. Operation of each vacuum breaker and backflow preventer.

END OF SECTION

**SECTION 220700
PLUMBING PIPE INSULATION**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM International (ASTM).
- B. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).
- C. North American Insulation Manufacturers Association (NAIMA).
- D. NAIMA – "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation".
- E. "National Commercial & Industrial Insulation Standards" – MICA Manual.
- F. National Fire Protection Association (NFPA).
- G. Underwriter's Laboratories (UL).
- H. Underwriter's Laboratories Environment (UL Environment).
 - 1. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

- A. Work of this Section includes, but is not limited to: Pipe insulation, Equipment insulation, Insulation adhesives, mastics and caulking.
- B. Definitions
 - 1. Concealed Insulated Surfaces: Piping and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts, sealed alleyways, and above suspended ceilings.
 - 2. Exposed Insulated Surfaces: Piping and equipment located in mechanical rooms, tunnels, and rooms without suspended ceilings.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics with a minimum of 10 years field experience who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds [if available]. Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold [if available].
- C. Recycled Content: A minimum of 50 percent recycled glass content certified and UL Validated.
- D. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants; whenever available.
- E. Comply with fire and smoke hazard ratings indicated.
 - 1. Test by procedure ASTM E84, NFPA 255, and UL 723.
 - 2. Accessories such as adhesives, mastics, cements, tapes, and glass fabric, same or better component ratings.
 - 3. Following are rating requirements: Flame spread (maximum): 25, Smoke developed (maximum): 50
 - 4. Properly identify products and/or their shipping cartons for flame and smoke ratings.
 - 5. Where prohibited by code or local ordinances, do not use elastomeric-type insulation anywhere within ceiling plenum return air systems.

1.04 SUBMITTALS

- A. Shop Drawings: Submit schedule indicating service, application, thickness and finishes.
- B. Product Data: Manufacturer's cut sheets and literature, Performance data.
- C. Samples: Not required for review.
- D. Reference Submittals: Not required for review.

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- E. Contract Close-Out Information: Manufacturer's installation, maintenance, and painting data, Guarantees.
- F. EPD or HPD Submittals: Third Party Validated.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Glass Fiber Pipe Covering: Knauf Insulation, Manville, Owens-Corning, Manson,
- B. Fire-Retardant Adhesive: Manville, Benjamin Foster, 3M, Insul-Coustic, Childers.
- C. Lagging Adhesive: Manville, Benjamin Foster, Borden, Insul-Coustic.
- D. Elastomeric Pipe Insulation and Equipment Covering: Armstrong Armaflex, IMCOA, Imcolock, Ultrafoam.
- E. Insulated Fitting Covers: Knauf Proto, Manville, Certain-Teed,
- F. Insulation Caulking: Dow No. 11.

2.02 GENERAL

- A. Provide fire and smoke hazard ratings as indicated for entire composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation).
- B. Do not use material that exceeds specified flame and smoke ratings.
- C. Use permanent treatments to jackets or facings to impart specified fire ratings.
- D. Use of water-soluble treatments is prohibited.
- E. At Hangers and Bracing: See Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".

2.03 PIPE INSULATION, NON-FLEXIBLE

- A. Pipe Insulation, Non-flexible
 - 1. Knauf Insulation Earthwool 1000 Pipe Insulation ASJ+/SSL+ pipe insulation Thermal conductivity (K value): Not greater than 0.23 at mean temperature of 75 deg F.
 - 2. Insulation thicknesses shall meet the minimum suggested requirements of ASHRAE 90.1 2013, IECC 2015 or local code requirements.
 - 3. Apply to the following piping in thickness indicated:
 - a. Domestic Potable & non-potable Cold Water:

Pipe Size	Insulation Thickness
2 inch and smaller	1/2 inch
2-1/2 inch and larger	1 inch

- b. Domestic Hot/Recirculating Water (thru 140 deg F):

Pipe Size	Insulation Thickness
1-1/2 inch and smaller	1 inch
2-1/2 inch and larger	1-1/2 inch

- c. Storm Water Piping: Including all vertical and horizontal rain leaders shall be 1 inch.

2.04 PIPE INSULATION, FLEXIBLE

- A. Pipe Insulation, Flexible
 - 1. Armstrong self-seal AP Armaflex flexible elastomeric pipe insulation.
 - 2. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75 deg F.
 - 3. Apply to following piping in thickness indicated: Waste piping from water coolers and drinking fountains: All sizes 1/2 inch

2.05 INSULATION FOR COLD EQUIPMENT

- A. Insulation for Cold Equipment:

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1. Armstrong Armaflex II sheet insulation; 1-1/2 inch material installed in 2 layers with joints staggered.
2. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75 deg F.
3. Apply to following equipment a thickness of 3/4 inch: Domestic water meter, Roof drain bodies

2.06 INSULATION FASTENERS

- A. Insulation Adhesive: Childers CP-82.
- B. Insulation Mastic: Childers CP-30.
- C. Insulation Caulking: Dow No. 11.

PART 3 EXECUTION

3.01 APPLICATION - GENERAL

- A. Do not insulate piping until satisfactory completion of required pressure tests.
- B. Apply insulation to clean, dry surfaces with pipe surfaces at room temperature.
- C. Butt insulation firmly together with longitudinal and end joints sealed with compatible jackets, facings and adhesives as specified.
- D. Apply adhesives, mastics and coatings per manufacturer's recommendations and as specified.
- E. On cold surfaces where vapor barrier jackets are used, apply insulation with a continuous, unbroken vapor seal. Adequately insulate and vapor seal hangers, supports, and anchors that are secured directly to cold surfaces to prevent condensation.
- F. Continue insulation through sleeves and wall and ceiling openings except insulation shall not continue through fire-rated (2-hour or greater) partitions, walls, floor-ceiling systems.
- G. Insulate all fittings, valve bodies, flanges and other pipeline accessories.
- H. At hangers and bracing, install in accord with Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".
- I. Contractors shall consult manufacturer's Technical Bulletins for detailed information on safety precautions in using all insulation products, polyurethanes, polyisocyanurates, and related materials. The data shall describe fire and other risks, safety in handling, toxicity, threshold limit values, physiological effects of inhalation and eye and skin contact, incompatibilities and other essential information regarding use. Obtain six (6) copies for distribution and use at jobsite and for submittal with shop drawing submittals.
- J. Roof Conductors: Insulate all horizontal and vertical piping.

3.02 FIBERGLASS INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes.
 1. Secure pipe insulation to pipe using self-sealing lap system.
 2. On high temperature piping, above 500 deg. F (260 deg. C), apply insulation using double layer and staggered joints. For double layer installation, secure the unjacketed inner layer using filament tape; without deforming insulation material. All joints and ends must be firmly butted and secured with appropriate securing material.
 3. Firmly rub all longitudinal and circumferential joints using a squeegee or sealing tool.
 4. Longitudinal jacket laps for pipe insulation installed on piping systems with operating temperatures below ambient shall be vapor sealed with factory-applied pressure sensitive adhesive vapor retarder, self-sealing lap. For proper sealing, firmly rub lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool. Vapor seal all circumferential joints with factory-furnished, matching pressure sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool. Additionally, coat raw edges of pipe insulation sections with vapor retarder mastic at 12 foot (3.6 m) to 21 foot (6.4 m) intervals; at Engineer's discretion on straight piping, and on either side of all fittings, flanges, or valves. Vapor retarder mastic shall completely coat the ends of the pipe and extend onto the bore of the pipe insulation and onto the jacketing

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a minimum of 2 inches (51 mm). Follow NAIMA's "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation" for additional details.

5. Install metal shields between hangers or supports and the pipe insulation. Install rigid insulation inserts as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation, and shall be vapor sealed as required. Insulation shields shall be no less than the following lengths:
 - a. 1-1/2 inch to 2-1/2 inch IPS: 10 inch (254 mm) long.
 - b. 3 inch to 6 inch IPS: 12 inch long.
 - c. 8 inch to 10 inch IPS: 16 inch long.
 - d. 12 inch and over IPS: 22 inch long
 6. For piping subject to abuse in mechanical rooms or high traffic areas, protect insulation from mechanical abuse by the use of appropriate thickness of PVC jacketing, metal jacketing, or laminated self-adhesive water and weather seal.
 7. For piping exposed to the elements, install a jacket that shall be UV resistant PVC with a minimum thickness of 0.030 inch, a minimum 0.016 inch thick aluminum jacket with factory-applied moisture barrier, or a minimum 0.010 inch thick stainless steel jacket with factory-applied moisture barrier. Fittings shall be of similar materials or outdoor weatherable PVC. Apply all jacketing per manufacturer's recommendations for the conditions.
- B. Insulation Installation for Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass blanket insulation.
 4. Install jacket material using manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed formaldehyde free fiberglass fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Fittings:
1. Install preformed formaldehyde free fiberglass fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.
- E. PIPE & TANK INSULATION
1. Apply on clean, dry surfaces.
 2. Cut to appropriate length using manufacturers' stretch out guide for the specific pipe size. Add an additional 2 inches to 4 inches (102 mm) for a staple flap.
 3. Install insulation around the duct circumference in a manner that ensures a firm fiber mesh at all joints. Fasten the longitudinal with outward clinching staples placed 3 inches on center. As an alternative, individual sections may be fastened in place using continuous and overlapping strands of 3/4" wide glass fiber filament tape around the insulation jacketing O.D. Longitudinal and circumferential joints shall be sealed with 4" wide matching pressure sensitive tape squeegeed along the entire length.
 4. For duct exposed to the elements, jacketing shall be UV resistant PVC with a minimum thickness of 0.030 inches, or 0.016 inches thick aluminum with factory applied

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moisture barrier or 0.010 inches thick stainless steel with a factory applied moisture barrier or laminated self-adhesive water and weather seals. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2" overlap joint. For systems operating below ambient, all PVC joints shall be sealed completely along the longitudinal and circumferential seams and installed so as to shed water. When required, all PVC circumferential joints shall be sealed by use of preformed butt strips; minimum 2" wide or a minimum 2" overlap. Butt strips shall overlap the adjacent jacketing a minimum ½ inch and be completely weather sealed. PVC Jacketing shall be limited to a maximum 20 inch OD of the insulation when exposed to direct sunlight. For systems operating above ambient, circumferential joints should overlap a minimum of 2" and not be sealed. Insulation thickness for duct covered by PVC Jacketing shall be such that the surface temperature of the PVC does not exceed 125°F (52°C).

5. ends at 12 foot to 21 foot intervals; at the Engineer's discretion, and on either side of fittings, flanges or valves before taping. Mastic shall extend a minimum of 2 inches onto the bore of the pipe and 2 inches onto the jacketing.

3.03 APPLICATION OF FLEXIBLE PIPE INSULATION

- A. Install tubing wherever possible by slipping material over piping. Otherwise, slit pipe insulation, tightly butt ends and seal butt joints and slit seams with suitable adhesive.
- B. Insulate fittings and valve bodies with segments cut from pipe insulation. Apply with adhesive.
- C. Insulate piping at hanger points with fiberglass material protected with metal saddles.

3.04 APPLICATION OF INSULATION ON COLD EQUIPMENT

- A. Apply with Armstrong 520 adhesive covering entire surface as well as back of insulation.
- B. Coat all butt edges and press firmly together with 1/8-inch overlay pressure.
- C. Apply two (2) coats of Armstrong Armaflex finish over sheet surfaces.

END OF SECTION

**SECTION 221116
DOMESTIC WATER PIPING AND DEVICES**

PART 1 - GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

- A. This Section applies to:
1. Potable Cold Water Piping
 2. Hot Water Piping
 3. Hot Water Recirculation Piping
 4. Raw Cold Water Piping
 5. Exterior Wall Hydrants (WH-1)
 6. Water Meter
 7. Strainers
 8. Water Hammer Arrestors
 9. Vacuum Breaker
 10. Drain Valves
 11. Temperature and Pressure Relief Valves
 12. Pressure Reducing Valve
 13. Escutcheons
 14. Backflow Preventors

1.03 QUALITY ASSURANCE

- A. General: Provide all supervision, labor, tools, materials, equipment, accessories and specialties necessary to completely install, clean and test the plumbing systems. All materials shall be free from defects impairing strength and durability and shall be of the best quality for the indicated purposes. All Work shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected; all Work shall be true to detail.
- B. Codes and Standards (Division 22 Section “Common Work Results for Plumbing” Listings and the following).
1. Plumbing installation shall be in accordance with the state and local plumbing code, and all other codes having jurisdiction.
 2. American Standard Code for Pressure Piping ANSI B31.1
 3. National Association of Corrosion Engineers
 4. American National Standards Institute (ANSI)
 5. American Society of Mechanical Engineers (ASME)
 6. American Society for Testing and Materials (ASTM)
 7. American Water Works Association
 8. Manufacturer's Standardization Society of the Valve and Fitting Industry
 9. Plumbing and Drainage Institute
 10. State Plumbing Code
 11. State Building Code
- C. Material Standards
1. ASTM B32-94: Specification for Solder, Metal Sizes.
 2. ASTM B42-93: Specification for Seamless Copper Pipe, Standard Size.
 3. ASTM B75-93: Specification for Seamless Copper Tube.
 4. ASTM B88-93a: Specification for Seamless Copper Water Tube.
 5. ASTM B251-93: Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
 6. ASTM B302-92: Specification for Threadless Copper Pipe.

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7. ASTM A53-94: Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
8. AWWA C651-92: Standard for Disinfecting Water Mains.

1.04 SUBMITTALS

- A. Shop Drawings" Valves: Submit in separate packages for each service/schedule as specified.
- B. Product Data: Catalog cuts.
- C. Samples: Not required for review.
- D. Reference Submittals: Not required for review.

1.05 HANDLING, DELIVERY, AND STORAGE

- A. General: Handling, delivery, and storage shall be in accordance with the manufacturer's recommendations. No extra cost shall be charged the Owner for handling, delivery, or storage. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.

PART 2 - PRODUCTS

2.01 PIPING

- A. General: The outside of all piping and fittings shall bear the Manufacturer's standard marking for type, pressure, etc. The A/E does not guarantee the accuracy of the figure numbers as listed.
- B. Pipe - General
 1. All carbon steel pipe shall be fabricated from open hearth or electrical furnaces. No Bessemer pipe shall be installed.
 2. All pipe and fittings shall be equal to or better than the grade specified.
 3. Whenever Specifications call for close bending or coiling, use Grade B pipe.
 4. All piping material shall be new and free from defects and shall be subject to standard mill test before being shipped.
 5. Pipe shall be labeled.
 6. Fittings and valves shall have the Manufacturer's name or trademark legibly raised or cut into each piece.
 7. All pipe shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs or oil.
 8. No salvaged or used pipe shall be used without the written approval of the A/E or Owner. Wherever such approval is given, recut the ends of the pipe, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.
- C. Domestic Water Pipe 4-inch Size and Smaller
 1. **Pipe:**
 - a. Copper tube, seamless, type L hard temper, ASTM B-88, above ground, and type K soft temper, 2-inch and smaller, below ground.
 - b. Copper Press-Connect, ASME B16.51
 2. **Fittings:** Cast brass or wrought copper, solder type, ASTM 75, ANSI B16.22..
 3. **Joints:** Soldered, 95-5 tin-antimony solder above ground, and silver solder below ground.
 4. **Unions:** Sweat-end, 150 lb. cast brass, ground joint.
 5. **Press Fittings**
 - a. Manufacturers: Pro-Press, Apollo, Streamline, Viega
 - b. Pipe: Copper press fittings may be used as an option, per ASTM B16.18 or ASTM B16.22.
 - c. Fittings: Press-Type fittings shall be joined using appropriate sized Tools per ASTM B88. Manufacturers: ProPress
 6. Mechanically formed tee connections and couplings, such as T-drill, are NOT acceptable.

2.02 PIPING AUXILIARIES / SPECIALTIES

- A. General: All auxiliaries and specialties shall be guaranteed by the manufacturer for the pressure, temperature and materials being handled. All auxiliaries and specialties shall be suitable for the piping to which they are attached.
- B. Wall Hydrants (WH-1): Manufacturers: Josam, J.R. Smith, Wade, Woodford, Mifab or Zurn.
- C. Water Meter: Meter is purchased from the utility company and installed by the Plumbing Contractor. Provide meter installation meeting utility company requirements.
- D. Strainers: Manufacturers: Sarco, Anderson, Armstrong, Crane, or Watts. Sarco type BT or BF-150, bronze body with stainless steel screen. Provide drain valve on strainer. Furnish and Install a "line-size" Y-Strainer on the inlet side of the backflow preventor.
 - 1. Furnish and Install a "line-size" Y-Strainer on the inlet side of the backflow preventor.
- E. Vacuum Breakers
 - 1. Manufacturers: Watts, Chicago Faucet, Febco, Wilkins, Conbraco, or Woodford.
 - 2. Hose Connections: ASSE 1011, Watts #8A, 3/4-inch hose thread. (#8AC in finished areas).
 - 3. Pressure Type Vacuum Breaker: ASSE 1020, Watts #800QT with ball valves and gauge cocks for 1-1/4 inch thru 2 inch size. ASSE 1056, Watts #008QT anti-spill-type for 1/2 inch through 1 inch size.
- F. Drain Valves: Powell 502-HS with cap and chain, or equal by Hammond, Keystone, or Watts.
- G. Temperature and Pressure Relief Valves: ASME-coded, All-bronze construction with seat-to-disc alignment that will not stick or freeze. Shall start to open at 230 deg F and shall be fully open at 240 deg F. Shall have snap action thermostat and sensing bulb sized to water heater Manufacturer's recommendations. Manufacturers: Watts, McDonnel, Wilkins, Conbraco.
- H. Pressure Reducing Valve: Valve shall automatically reduce a higher inlet pressure to a steady lower downstream pressure. Must meet "Reduction of Lead in Drinking Water Act". All bronze body and cover. Outlet pressure shall be set to 65.0 psi
Manufacturer: Cla-Val Model CRD-L for sizes 1/2" to 2-1/2" pipe sizes
- I. Escutcheons shall be one-piece, steel type with polished, chrome-plated finish and setscrew fastener. Install pipe escutcheons at ALL pipe penetrations thru walls that are visible by public view.
- J. Backflow Preventor: Where indicated on the plumbing drawings furnished and install a Reduced Pressure Zone Assembly to prevent backsiphonage and backpressure conditions. The Lead-Free assembly shall consist of two shut-off valves, relief valve and two check valves.
 - 1. Provide with Air-Gap device and route drain piping to floor drain.
 - 2. Furnish and Install a "line-size" Y-Strainer on the inlet side of the backflow preventor.
 - a. Sizes 2" and larger shall be a flanged, Wye Pattern cast-iron strainer similar to Watts # 77F-DI-FDA-125
 - b. Sizes less than 2" in size shall be Wye-Pattern, lead free cast strainer Watts # LF777SI
 - 3. Install center-line of backflow preventor + 24" A.F.F.
 - 4. Backflow Assemblies less than 2" in size shall be similar to Watts # LF909
 - 5. Backflow Assemblies 2-1/2" and larger in size shall be similar to Watts # LF909
 - 6. Approved Manufacturers: Watts, Wilkens

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. General
 - 1. Comply with Division 22 Section "Common Work Results for Plumbing", as well as the requirements of Division 22 Sections "Hangers and Supports for Plumbing Piping, and "Plumbing Insulation".

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2. Piping shall be installed in a manner which permits easy removal of valves and disconnection of equipment. Unions or flanged joints shall be installed for this purpose.
 3. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.
 4. Piping shall not be supported from other pipes, conduits, ducts or similar installations.
 5. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.
 6. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the run-outs of main piping, and shall be installed by the use of multiple elbows or other similar methods to minimize strain on the equipment connections.
 7. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.
 8. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping.
 9. All open ends of pipes, including equipment connections, shall be properly sealed at all times during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.
 10. Pipe size reductions shall be made with factory-fabricated eccentric reducers or reducing fittings and shall be installed in a manner which does not cause pocketing or inhibit the flow of the material.
 11. Install shut-off service valves with unions on all connections to equipment and on each side of control valves as required for ease of proper servicing and maintenance; see Division 22 Section "General Duty Valves for Plumbing Piping".
 12. Unless otherwise indicated, the discharge from pressure-and temperature-relief valves and equipment drains shall be piped to the nearest floor drain, hub drain, or mop sink, installed with an approved air gap as required, and arranged for safe discharge.
 13. No pipe shall penetrate any structural member without the written approval of the A/E. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the A/E.
 14. Dielectric Separation: Provide dielectric separation at all copper piping and valves connected to ferrous piping. Brass or bronze valves installed in ferrous piping shall not require dielectric separation. Connections between copper piping and ferrous flanged piping and equipment connections shall be with a bronze companion flange with dielectric separation for flanges and bolts. Connections between copper piping and screwed ferrous piping shall be Clearflow Dielectric Waterway fittings.
 15. Movement: Mains: Provide adequate offsets, bends, loops, flexible joints and guides as required to prevent over-stressing of piping and/or the structure. Branches: Provide for expansion and contraction by means of offsets, swings, joints or loops to eliminate stress on connected piping, valves or equipment. Provide for proper drainage as required. Maintain a free floating, properly braced and supported piping system.
 16. Provide all rough-in and final connections to equipment and services indicated in the Contract Documents for equipment and services to be functional.
 17. Pipe Sleeves shall be installed at ALL pipe penetrations of floors.
- B. Cross Connections and Interconnections: No plumbing fixtures, devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.
- C. Painting of Piping: Refer to Division 09 Section "Interior Painting".

3.02 BUILDING PIPING SYSTEM: INSTALLATION

- A. Domestic Water: Cold, Hot, Recirculating: All piping shall be installed and pitched to provide proper drainage. Install drain valves at all low points and as required to provide drainage facilities for the piping. Wherever system is sectionalized, install drain valves between each

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sectional shut-off valve. All hot water piping shall be pitched to provide natural gravity recirculation regardless of a recirculation pump. Install pressure gauge in domestic cold water main at water entrances to building.

- B. Shock Elimination: All piping shall be protected against water shock. Install a water hammer arrestor of the proper size at the end of the main, at the end of all branch lines, and at the end of lines serving groups of fixtures. Water hammer arrestors shall be sized and installed as recommended by the Plumbing and Drainage Institute (PDI) and shall eliminate water hammer. All water hammer arrestors shall be installed in locations where they are readily accessible for service. Where required, provide suitable access doors. Note: Install water hammer arrestors on each water line serving laundry clothes washers.
- C. Contamination Protection: Provide an approved in-line double check backflow preventer at each connection to a fixture where indicated or required by code. Such fixtures shall include coffee makers, ice makers, clothes washers, etc.
- D. Backflow Prevention: Install a code approved backflow preventer unit in the service main, where indicated on the Drawings, or as required by code. Include in-line strainer, dual-service shut-off valves, double-check valves, and check cocks. Install pressure gauge on inlet and outlet side of backflow preventor. Properly support unit, independent of the piping, with union connections.
- E. Water Meter: Arrange for and pay all costs involved in the installation of a water meter in the building service line, where indicated. Support independent of the piping with union connections. Installation and meter shall be in accord with and approved by the water utility company. The Contractor is responsible for contacting the local water utility for meter setting and coordination of work.

END OF SECTION

SECTION 221199
PEX PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Domestic water piping and fittings for the following applications:
 - 1. Domestic cold water piping
 - 2. Domestic hot water piping
 - 3. Domestic hot water recirculation piping

1.02 RELATED SECTIONS

- A. Section 22 11 13 — Facility Water Distribution Piping
- B. Section 22 07 19 — Plumbing Piping Insulation
- C. Section 22 05 29 — Hangers and Supports for Plumbing Piping and Equipment

1.03 REFERENCES

- A. ASTM International (ASTM)
 - 1. ASTM D 2765 Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics.
 - 2. ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 - 3. ASTM D 6394 Specification for Sulfone Plastics (SP).
 - 4. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 5. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 6. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - 7. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 - 8. ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
 - 9. ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
 - 10. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Crosslinked Polyethylene (PEX) Tubing.
 - 11. ASTM F2023 Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water
 - 12. ASTM F2657 Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing
- B. American Water Works Association
 - 1. AWWA C904 Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2 in. Through 3 in., for Water Service.
- C. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)
 - 1. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials
 - 2. ANSI/NSF Standard 61 Drinking Water System Components - Health Effects
 - 3. ANSI/NSF Standard 359 Valves for Crosslinked Polyethylene (PEX) Water Distribution Tubing Systems
 - 4. ANSI/NSF Standard 372 Drinking Water System Components – Lead Content
- D. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL)
 - 1. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials.
 - 2. ANSI/UL 2846 Standard for Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics.
- E. American Society of Mechanical Engineers (ASME)

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1. ASME B 16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
 2. ASME B16.51 Copper and Copper Alloy Press-Connect Pressure Fittings.
- F. International Code Council (ICC)
1. International Plumbing Code (IPC)
 2. Evaluation Service Report PMG-1006 and PMG-1412
 3. ICC-ES PMG — 1106
 4. International Association of Plumbing Officials (IAPMO)
 5. Uniform Plumbing Code (UPC)
 6. Evaluation Report 253
- G. Plastics Pipe Institute (PPI)
1. PPI Technical Report TR-4
- H. Underwriters Laboratories (UL)
1. UL 2846 Standard for Fire Tests of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics.
- I. Uponor Inc.
1. Uponor Piping Systems Installation Guide, current edition.
 2. Uponor Plumbing Design Assistance Manual, current edition.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 — Administrative Requirements.
- B. Product data: Provide manufacturer's product submittal data.
- C. Shop drawings: Provide installation drawings indicating piping layout, size dimension by installation segment, vault locations, support fixtures and schedules with all details required for installation of the system.
- D. Samples: Submit selection and verification samples of piping.
- E. Quality assurance/control submittals
1. Test reports: Upon request, submit test reports from recognized testing laboratories.
 2. Submit the following documentation.
 - a. Manufacturer's certificate stating that products comply with specified requirements.
- F. Closeout submittals: Submit the following documents.
1. Warranty documents specified herein.
 2. Operation and maintenance data.
 3. Manufacturer's field reports specified herein.
 4. Final as-built piping layout drawing.

1.05 QUALITY ASSURANCE

- A. Installer qualifications: Installer shall have successfully completed the Uponor Piping Systems Training Course and is able to provide proof/verification. Course shall be conducted by the manufacturer or a manufacturer's representative.
1. Regulatory requirements and approvals: Ensure the piping distribution system complies with all applicable codes and regulations.
 2. Certifications: Provide letters of certification indicating: Installer uses skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed tradesperson.
 3. Pre-installation meetings:
 - a. Verify project requirements, excavation conditions, system performance requirements, manufacturer's installation instructions and warranty requirements.
 - b. Review project construction timeline to ensure compliance or discuss modifications as required.
 - c. Interface with other trade representatives to verify areas of responsibility.

- d. Establish the frequency and construction phase the project engineer intends for site visits and inspections by the tubing manufacturer's representative.

1.06 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with Division 1 Product Requirement Section.
- B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 1. Store PEX piping in cartons or under cover to avoid dirt or foreign material from entering the piping.
 2. Do not expose white PEX tubing to direct sunlight for more than one month or red or blue PEX tubing to direct sunlight for more than 6 months. If construction delays are encountered, cover the tubing to prevent exposure to direct sunlight.
 3. Store piping on a flat surface to prevent unwanted deformation.

1.07 WARRANTY

- A. Project warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's warranty: PEX-a manufacturer system warranty shall cover piping and fittings for a duration of 25 years from the date of installation. Piping system warranty shall apply to potable water distribution and water service systems constructed of pipe and fitting products sourced from the same manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturer: Uponor, Viega Pureflow
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 — Product Requirements.

2.02 DOMESTIC WATER PIPING AND FITTINGS

- A. Performance requirements:
 1. PEX-a piping and fittings shall meet the following pressure and temperature ratings per ASTM F876:
 - a. 200 degrees F (93 degrees C) at 80 psi (551 kPa).
 - b. 180 degrees F (82 degrees C) at 100 psi (689 kPa).
 - c. degrees F (23 degrees C) at 160 psi (1,102 kPa).
 2. PEX-a piping and fittings shall be tested for compliance by an independent third-party agency.
 3. Minimum bend radius (cold bending): Six times the outside diameter.
 4. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings through UL.
 - a. UL Design No. L557 1 hour wood frame floor/ceiling assemblies.
 - b. UL Design No. K913 2 hour concrete floor/ceiling assemblies.
 - c. UL Design No. U372 1 hour wood stud/gypsum wallboard wall assemblies.
 - d. UL Design No. V444 1 hour steel stud/gypsum wallboard wall assemblies.
 5. PEX-a piping shall be tested to comply with the ASTM F2023 requirement for minimum chlorine resistance at the end use condition of 100% of the time at 140°F (60°C) at 80 psi (0.55 MPa) gauge pressure.
 - a. PEX-a piping and tubing material designation codes shall be PEX 5106 or PEX 5306.
- B. Piping:
 1. Uponor AquaPEX®

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- a. PEX-a (Engel-method crosslinked polyethylene), ASTM F876 and F877 (CAN/CSA-B137.5), SDR 9, CTS, 1/2 inch (16mm) through 3 inch (75mm) nominal pipe size.
 2. Uponor AquaPEX pre-sleeved piping
 - a. High-density polyethylene (HDPE) corrugated sleeved PEX-a (Engel-method crosslinked polyethylene), ASTM F876 and F877 (CAN/CSA-B137.5), SDR 9, CTS, 1/2 inch (16mm) and 3/4 inch (19 mm) nominal pipe size.
 3. Uponor pre-insulated piping
 - a. Factory fabricated and assembled Uponor AquaPEX PEX-a piping with a closed-cell polyethylene foam insulation, 1/2 inch (16mm) through 2 inch (51mm) nominal pipe size.
 - 1) Insulation shall not be exposed to groundwater
- C. Fittings:
1. Uponor ProPEX®
 - a. Third-party certified to NSF 14 and ASTM F1960 cold-expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from the following material types:
 - b. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".
 2. Uponor multiport tees and elbows: Multiple-outlet fitting complying with ASTM F877 (CAN/CSA B137.5); with ASTM F1960 inlets and outlets.
 3. Uponor manifolds: Multiple-outlet assembly with ASTM F 1960 outlets.
 - a. Type L copper branch manifold with lead-free brass valve outlets.
 - b. Type L copper branch manifold without valves, with lead-free brass outlets.

2.03 TRANSITION FITTINGS

- A. PEX-to-metal transition fittings:
1. Manufacturers: Provide fittings from the same manufacturer of the piping.
 2. Third-party certified to NSF 14 and ASTM F1960 cold-expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from the following material types:
 3. PEX-a to thread transition: One-piece Lead free (LF) brass fitting with male or female threaded adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
 4. PEX-a to copper sweat transition: One-piece lead free (LF) brass fitting with sweat adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
 5. PEX-a to copper press transition: One-piece lead free (LF) brass fitting with one ASME B16.51 copper press end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
 6. PEX-a to flange transition: Two-piece fitting with one steel flange conforming to ASME B 16.5 and one lead free (LF) brass adapter conforming to ASTM F1960.
 7. PEX-a to groove transition: One-piece lead free (LF) brass fitting with one CSA B242-05 groove end in either iron pipe size (IPS) or copper tube size (CTS) and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
 8. PEX-a to water meter transition: Two-piece fitting with one NPSM union thread and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- B. PEX-to-thermoplastic transition fittings:
1. PEX-a to CPVC transition: Thermoplastic fitting with one spigot or socket end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

2.04 VALVES

- A. PEX-to-PEX, lead-free (LF) brass ball valves (1/2 inch (13 mm) through 2 inch (50 mm) nominal pipe size)
1. Manufacturers: Provide ball valve(s) from the same manufacturer as the piping system.

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2. Full-port ball valve: two-piece, ASTM F1960 cold-expansion ends, with PEX-a reinforcing cold-expansion ring.
 3. LF brass valve with a positive stop shoulder.
 4. In compliance with 250 CWP, ANSI/NSF 359, ANSI/NSF 372, ANSI/NSF 14/61, cNSF-us-pw_G lead free 0.25% lead maximum, ASTM F1960, ASTM F877 (CAN/CSA B137.5).
 5. Provide stem extension kits for insulated piping.
- B. PEX-to-NPSM, lead-free (LF) full-port brass water meter service valve
1. 3/4 inch PEX x 1 inch NPSM straight and elbow
 2. 1 inch PEX x 1-1/4 inch NPSM straight and elbow
 3. Metal and polypropylene NPSM union nut
 4. In compliance with 250 CWP, ANSI/NSF 359, ANSI/NSF 14/61, cNSF-us-pw_G lead free 0.25% lead maximum, ASTM F1960, ASTM F877 (CAN/CSA B137.5).

PART 3 – EXECUTION

3.01 EXAINATION

- A. Site verification of conditions: Verify that site conditions are acceptable for installation of the domestic water piping. Do not proceed with installation until unacceptable conditions are corrected.

3.02 INSTALLATION

- A. Install domestic water piping according to approved shop drawings and coordination drawings.
- B. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following.
1. Install PEX piping system in compliance with the Uponor Plumbing Design Assistance Manual (PDAM), current edition, and the Uponor Piping Systems Installation Guide, current edition.
 2. PEX shall not be installed in areas within five feet of a UV light source, such as LED and fluorescent light fixtures or other UV generating devices.
 3. White PEX shall not be installed outdoors where it is exposed to direct sunlight light for more than one month; red or blue PEX shall not be installed outdoors where it is exposed to direct sunlight for more than six months.
 4. PEX piping shall be installed per ASTM E84 requirements for plenum applications.
 5. Install PEX-a Pipe Support and provide all required hangers and supporting strapping as required by manufacturer to provide a code compliant installation.
 6. Install PEX piping in straight runs free of sags and kinks and provide bend supports at all 1/2 inch and 3/4 inch drops.
 7. All PEX piping penetrations through wall plates shall be protected or shielded as required to prevent damage to piping.
 8. PEX tubing passing through metal studs shall use grommets or sleeves at the penetration.
 9. Install PEX piping from the multiport tee or manifold to each fixture as a home run.
 10. Install PEX-a Pipe Support, fixed anchor points and hangers in compliance with Uponor Plumbing Design Assistance Manual (PDAM) to minimize expansion and contraction.
 11. Install PEX piping at each fixture with out of the wall support bracket to secure piping and prevent excess movement when water stops or shut valves are operated.
 12. Install all PEX manifolds centered in access panels to permit servicing.
- C. Below-ground and in-slab installation
1. Install PEX piping system in compliance with the Uponor Plumbing Design Assistance Manual (PDAM), current edition and the Uponor Piping Systems Installation Guide, current edition.
 2. White PEX shall not be installed outdoors where it is exposed to direct sunlight light for more than one month; red or blue PEX shall not be installed outdoors where it is exposed to direct sunlight for more than six months.
 3. Install support strapping as required by manufacturer to provide a code-compliant installation.

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4. Install PEX piping free of kinks.
 5. PEX piping penetrations through slabs shall be protected by PEX stand-up brackets or PVC bend supports to prevent damage to piping.
 6. Install PEX piping from the manifold as a home run. No joints shall be installed in the slab.
 7. Insulation shall not be exposed to groundwater.
 8. The piping system will be installed with the fewest number of underground joints as possible.
- D. Backfill
1. The piping system will be backfilled with clean sand material.
 - a. Minimum vertical distance from the bottom of the tubing to the trench floor is 4 inches (100 mm).
 - b. Minimum lateral distance from the side of the tubing to the trench wall is 6 inches (150 mm).
 - c. Install a minimum of 12 inches (300 mm) of clean fill over the top of the piping.
 2. The balance of the trench can be backfilled with native soil void of stone greater than 2 inches (50mm) in diameter.
- E. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following:
1. Uponor Piping Systems Installation Guide, current edition.
 2. Uponor Plumbing Design Assistance Manual, current edition.
- F. PEX-a hangers and supports
1. Horizontal PEX-a piping: Install supports suitable for PEX-a piping in compliance with local codes and the Uponor Piping Systems Installation Guide, current edition.
 - a. Note: Per ICC PMG-1006, the above maximum hanger spacing requirements may be extended with the use of a continuous support channel such as Uponor PEX-a Pipe Support.
 2. Horizontal PEX-a piping with PEX-a Pipe Support: Install supports for PEX-a piping with horizontal support channel in accordance with manufacturer's recommendations and the following maximum spacing:
 - a. 3 inch nominal and smaller: Maximum span, 8 feet (2.4 m).
 - b. Support 1-1/2 inch and smaller fittings within 12 inches (0.3 m).
 - c. Install clamps and fixed points per the Uponor Piping Systems Installation Guide, current edition.
 3. Vertical PEX-a piping: Install supports suitable for PEX-a piping in compliance with local codes and the Uponor Piping Systems Installation Guide, current edition:
 - a. Support vertical in-wall piping every 5 feet (1.5 m).
 - b. Support riser piping at the base of each floor and every 5 feet (1.5 m) vertically.
 - 1) Refer to the Uponor Piping Systems Installation Guide, current edition, for additional requirements.
- G. Piping schedule
1. Above ground domestic water piping shall be the following:
 - a. 3 inch (75mm) and smaller
 - 1) PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings.
 - b. 2 inch (51mm) and smaller:
 - 1) Pre-Insulated PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings.
 2. Domestic water piping installed below ground shall be any of the following:
 - a. 3 inch (75mm) and smaller:
 - 1) PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings. No joints or fittings shall be installed under slab. Protect all slab penetrations.
 - b. 2 inch (51mm) and smaller, not exposed to groundwater:

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- 1) Pre-Insulated PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings. No joints or fittings shall be installed under slab. Protect all slab penetrations.
 3. Domestic water piping installed within slabs shall be the following:
 - a. 3 inch (75mm) and smaller:
 - 1) PEX-a piping. No joints or fittings shall be installed within slab. Protect all slab penetrations.
 - b. 1/2 inch (13 mm) and 3/4 inch (19 mm):
 - 1) Pre-sleeved PEX-a piping. No joints or fittings shall be installed within slab. Protect all slab penetrations.
 - c. 2 inch (51mm) and smaller:
 - 1) Pre-Insulated PEX-a piping. No joints or fittings shall be installed within slab. Protect all slab penetrations.
- H. Pipe joint construction
1. PEX-a connections:
 - a. Install per manufacturer's recommendations.
 - b. Use manufacturer-recommended cold-expansion ProPEX tool for ASTM F1960 connections.

3.03 FIELD QUALITY CONTROL

- A. Pressure testing PEX pipe and fittings: Pressure test PEX-a piping systems in accordance with local code and manufacturer's requirements.
- B. System flushing, pressure testing and system conditioning procedure:
 1. Hydrostatic pressure testing shall be completed in accordance with local Codes and the Uponor Plumbing Design Assistance Manual (PDAM).
 2. Leave joints uninsulated and exposed for the duration of the test.
 3. Flush the domestic water system with ambient temperature, clean, potable water unless there is a risk of damage due to freezing.
 4. After completing each hydrostatic leak testing procedure, drain the system until empty.
 5. If testing with compressed air, do not exceed 120 psi.

3.04 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Repair or replace damaged installed products.
- C. Clean the installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
- D. Water system disinfection
 1. Uponor AquaPEX piping should be disinfected in accordance with AWWA C651, Standard for Disinfecting Water Mains, or local codes.
 2. Use non-petroleum-based cleaners
 3. Not exceed a pH of 11
 4. Have water temperatures less than 140°F (60°C)
 5. Use a chlorine solution of 50 parts per million (ppm) for 24 hours or 200 ppm for three hours for disinfection.
 6. To prevent reduced service life of system components, disinfection solutions should not stand in the system longer than 24 hours. Flush the system with potable water after disinfection.

3.05 PROTECTION

- A. Protect installed work from damage caused by subsequent construction activity on the site.

END OF SECTION

**SECTION 221300
SANITARY SEWER SYSTEMS**

PART 1 - GENERAL

1.01 SCOPE

- A. Floor Drains
 - 1. Trap Guards
 - 2. Hub Drains
 - 3. Cleanouts
 - 4. Backwater Valves
- B. Related Documents:
 - 1. Section 22 11 00 - Water Distribution
 - 2. Section 22 13 00 - Sanitary Sewerage (Sanitary Waste and Vent Piping)
 - 3. Section 22 14 00 - Storm Drainage

1.02 REFERENCE

- A. Applicable provisions of all Sections 22 shall govern work under this section.

1.03 REFERENCE STANDARDS

- A. ANSI A112.14.1 - Backwater Valves
- B. ANSI A112.21.1 - Floor Drains.
- C. ANSI A112.21.2 - Roof Drains.
- D. ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.
- E. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
- F. ASSE 1010 - Water Hammer Arrestors.
- G. ASSE 1011 - Hose Connection Vacuum Breakers.
- H. ASSE 1012 - Backflow Preventers with Intermediate Atmospheric Vent.
- I. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
- J. ASSE 1018 - Trap Seal Primer Valves.
- K. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

1.04 QUALITY ASSURANCE

- A. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions..
- B. Plumbing products requiring approval by the State of Indiana.

1.05 SHOP DRAWINGS

- A. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.06 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

- A. Manufacturer: J.R. Smith, Wade, Zurn.
- B. Grates and Covers:
 - 1. Medium duty unless specified otherwise) in areas not subject to equipment loads. Secure with vandal resistant screws.

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2. Heavy duty (or reinforced) in areas which are subject to heavy equipment loads.
3. Contractor shall coordinate location of drains indicated on plumbing drawings with structural / general contractor.
4. See Floor Drain Schedule on drawings for model numbers and drain descriptions.

2.02 PLUMBING DRAINS

- A. FD-1: Equipment Drain with Funnel: (On Grade)
 1. Duco cast iron body with integral deep seal cast iron p-trap, with flashing flange and clamping collar, with round adjustable nickel bronze strainer, with round adjustable nickel bronze cleanout plug with solid secured cover.
 2. Install 4" diameter nickel bronze funnel assembly.
 3. Provide with trap-primer connection.
- B. FD-2: Floor Drain: (On Grade)
 1. Duco cast iron body with integral deep seal cast iron p-trap, with flashing flange and clamping collar, with round adjustable nickel bronze strainer, with round adjustable nickel bronze cleanout plug with solid secured cover.
 2. Provide with trap-primer connection.

2.03 TRAP PRIMERS

- A. When required by local Plumbing / Building Codes, contractor shall install trap-primers to all floor drains.
- B. Manufacturers: J.R. Smith Fig # 2694-NP and # 2683-3 Distribution Unit, Watts 3 LFTP300.

2.04 TRAP GUARDS

- A. Manufacturer: Manufacturer: JR Smith Quad Close, model #2692 Series, or Sure-Seal # SS2009V with new back-check cover.
- B. Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains and hub drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4" size. This product to be tested and certified to the requirements of ASSE 1072 & IAPMO Research and Testing, Inc., and any subsequent submittal must contain a certificate of compliance listing all the approved sizes.
- C. Contractor to verify with local plumbing inspector that flexible type trap guard devices are allowed. When the use of trap guard devices are not allowed, install a "Watts" Series A200, flow-thru trap primer.

2.05 CLEANOUTS

- A. Manufacturer: Josam, J.R. Smith, Wade, Watts, Zurn.
- B. Exterior Unpaved Areas: CO-1, Cast iron hub or plug with tapered threaded PVC closure plug, cast iron or PVC frost sleeve and cover set in 24" square by 4" min. thick reinforced concrete pad top. Neenah R-1976 with non-ferrous securing screw.
 1. Interior Concrete Floor Areas: CO-2, Enameled cast iron body with round adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400- / ZN-1400-T.
 2. Interior Finished Wall Areas: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Zurn Z-1446- (Note: Screw shall not pass completely through the ABS plug, trim screw as necessary)
 - a. Interior Exposed Vertical Stacks: Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.
 - b. Interior Horizontal Lines: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.
- C. Exterior Unpaved Areas: CO-1, Cast iron hub or plug with tapered threaded PVC closure plug, cast iron or PVC frost sleeve and cover.

2.06 SEWER CAMERA INSPECTION

- A. The cost of the camera inspection shall be at the expense of the Contractor.
- B. The camera inspection shall be performed within 14 days after the sanitary sewer mains have been cleaned and/or rodded out.
- C. The camera inspection shall be performed on all sanitary sewer mains 4" and larger before any new work is performed on the sewer piping.
- D. Record inspection data using high-quality video media such as DVD or other approved media.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.
- B. Set floor drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.
- C. Floor drains and hub drains installed in public restrooms, locker rooms, seldom used rooms, and areas with minute drainage flow shall have a trap guard device installed.
- D. During construction, floor drains and drench drains shall be protected from dirt and debris. Contractor shall cover drains with temporary tape or coverings to be removed once construction is complete.
- E. Adjust receiver height to drain tile inlet and outlet elevations and cleanout to finished floor elevation.
- F. Floor Drains shall be installed to allow the strainer to be recessed 1/4" below finished floor. Drain shall have a slopped 12" sweep around outside diameter of strainer.

END OF SECTION

**SECTION 221316
SANITARY WASTE AND VENT PIPING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.

1.02 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
 - 2. Waste, Force-Main Piping: 100 psig.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.04 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: (When Required) For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.06 MANUFACTURERS

- A. Charlotte Pipe and Foundry Co., North American Pipe Corp.

1.07 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Construction Manager and Owner no fewer than five days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 PIPING BELOW GRADE:

- A. HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS
 1. (NOTE: Use Cast-Iron Piping Only Where Indicated on Drawings, Such As Kitchen and Laundry Areas.)
 2. Pipe and Fittings: ASTM A 74, CISPI, Service and Extra Heavy classes.
 3. Gaskets: ASTM C 564, rubber.
 4. Calking Materials: ASTM B 29
- B. PVC PIPE AND FITTINGS
 1. Pipe: Solid wall Schedule 40 PVC.
 2. Pipe Compound: ASTM D1784 Cell Class 12454.
 3. End Type: Belled
 4. Lay Length: Max. 10 ft.

2.03 PIPING ABOVE GRADE:

- 1. PVC PIPE AND FITTINGS
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- E. Adhesive Primer: ASTM F 656.
 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Solvent Cement: ASTM D 2564.
 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 3. Unshielded, Non-pressure Transition Couplings:
 - a. Manufacturers:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - 5) Husky
 - b. Standard: ASTM C 1173.

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- c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- 4. Shielded, Non-pressure Transition Couplings:
 - a. Manufacturers:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 EXECUTION

3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

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- L. Exterior Sewers: Maintain a minimum of 48" above top of pipe to finished grade. Verify burial depth of sewer piping with local city / county sewer department.
- M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated: Invert elevations of sanitary waste piping are generally indicated on the Plumbing Foundation drawing.
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping 3 inch and smaller; 1 percent downward in direction of flow for piping 4" and larger.
 - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install steel piping according to applicable plumbing code.
- P. Install aboveground PVC piping according to ASTM D 2665.
- Q. Install underground ABS and PVC piping according to ASTM D 2321.
- R. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - 2. Install drains in sanitary drainage gravity-flow piping.
- S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors where exposed to public view.

3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- H. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

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1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.
 2. In Aboveground Force Main Piping: Fitting-type transition couplings.
 3. In Underground Force Main Piping:
 - a. Piping 1-1/2" and Smaller: Fitting-type transition couplings.
 - b. Piping 2" and Larger: Pressure transition couplings.

3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Install horizontal backwater valves in pit with pit cover flush with floor.
 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections 2-1/2" and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping 2" and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping 2" and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.06 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

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2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.07 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed Vent Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

**SECTION 223000
PLUMBING EQUIPMENT**

PART 1 - GENERAL

1.01 SCOPE

- A. This section includes specifications for:

PART 1 – GENERAL

2.01 SCOPE

2.02 RELATED DOCUMENTS

2.03 REFERENCE

2.04 QUALITY ASSURANCE

2.05 SHOP DRAWINGS

2.06 OPERATION AND MAINTENANCE DATA

PART 2 – PRODUCTS

3.01 WATER HEATERS – ELECTRIC

3.02 WATER SOFTENERS

3.03 CIRCULATING PUMPS

3.04 CONDENSATE PUMPS

3.05 BOOSTER PUMPS (ALTERNATE, IF REQUIRED)

3.06 EXPANSION TANKS

3.07 THERMOSTATIC MIXING VALVES

PART 3 - EXECUTION

4.01 INSTALLATION

4.02 CONSTRUCTION VERIFICATION ITEMS

4.03 FUNCTIONAL PERFORMANCE TESTING

4.04 TRAINING

4.05 RELATED DOCUMENTS

- A. Section 01 91 01 or 01 91 02 – Commissioning Process
- B. Section 22 08 00 – Commissioning of Plumbing
- C. Section 22 05 23 - General-Duty Valves for Plumbing Piping
- D. Section 22 05 15 - Piping Specialties
- E. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment.
- F. Section 22 07 00 - Plumbing Insulation
- G. Division 26 00 00 - Electrical

4.06 REFERENCE

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Plumbing products requiring approval by the State of Indiana must be approved or have pending approval at the time of shop drawing submission.

4.07 SHOP DRAWINGS

- A. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

4.08 OPERATION AND MAINTENANCE DATA

- A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.
- B. NOTE: All plumbing products and devices must meet the Federal Public Law 111-380, The Reduction of Lead in Drinking Water Act, effective January 04, 2014.

PART 2 - PRODUCTS

5.01 HIGH EFFICIENCY COMMERCIAL GAS FIRED WATER HEATER

5.02 DIRECT VENT VERTICAL SYSTEM: VERTICAL ROOF TOP TERMINATION OF BOTH THE VENT AND COMBUSTION AIR. THE FLUE SHALL BE CPVC OR STAINLESS STEEL SEALED VENT MATERIAL TERMINATING AT THE ROOF TOP WITH THE MANUFACTURERS SPECIFIED VENT TERMINATION. A SEPARATE PIPE SHALL SUPPLY COMBUSTION AIR DIRECTLY TO THE WATER HEATER FROM THE OUTSIDE. THE AIR INLET PIPE MAY BE CPVC PIPE. THE AIR INLET MUST TERMINATE ON THE ROOF TOP WITH THE MANUFACTURER'S SPECIFIED AIR INLET CAP.

5.03 DUE TO LIMITED FLOOR SPACE, THE WATER HEATERS WILL BE REQUIRED TO HAVE THE "STACKED-FRAME" OPTION.

5.04 ELECTRIC WATER HEATERS

- A. Manufacturer: A.O. Smith, Lochinvar, Rheem, State
- B. Install the following accessories on each water heater: 1. Relief valve. 2. Drain valve 3. Thermometer.

5.05 TYPE: POINT OF USE, COMPACT, ELECTRIC WATER HEATER. SIZE AND ENERGY REQUIREMENTS ARE LISTED ON THE DRAWING SCHEDULE. HEATER SHALL BE PROVIDED WITH THE FOLLOWING ITEMS.

- A. Adjustable Thermostat control
- B. Replaceable immersion heating elements
- C. Glass-Lined steel storage tank
- D. Temperature and pressure relief valve.
- E. Brass drain valve.
- F. Contractor shall furnish and install wall mounting self to support water heaters 20.0 gallons and larger. Mounting height if shelf @ min. 7'-0" A.F.F.
- G. Contractor shall furnish and install a thermostatic mixing valve (TMV) to externally control hot water. TMV shall be similar to Watts – Model # 3/4LF 1170-UT-M2 3/4" See valve schedule for size and flow.
- H. Warranty: 1 year, limited tank and parts.

5.06 TEMPERATURE AND PRESSURE GAUGE

5.07 150 PSI TEMPERATURE AND PRESSURE RELIEF VALVE

5.08 SIZE AND CAPACITY: SEE SCHEDULE ON DRAWINGS.

5.09 MANUFACTURERS: O.A. SMITH, LOCHINVAR.

5.10 WATER SOFTENERS

- A. Automatic Water Softener System: Complete from inlet to outlet, designed within values scheduled herein; of capacity and arrangement as shown on drawings and specified herein; furnished, installed and placed in operation.
- B. Acceptable Manufacturer(s): Aqua Systems, Puritan.
- C. Softener Tank(s) one piece, nonmetallic, seamless construction with continuous fiberglass roving outer shell; rated at 150 psig at 120 Deg. F.
- D. Minimum connection size: 2" female connections.

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- E. Brine System: single brine measuring and salt storage tank (min. size 24"x48") with salt platform (sufficiently sized for at least four regenerations at full salting); tank and cover constructed of fiberglass or molded polyethylene; full-operated plastic fitted brine valve for automatic control of brine withdraw and fresh water refill.
- F. Electrical Characteristics:
- G. As scheduled and indicated on drawings, typically 120 volt single phase.
- H. Control: Brass control "Fleck" valve, cycled to regenerate from one to twelve day period.
- I. Softener Tank (Each): Reinforced fiberglass tank with hub and lateral distribution system. See schedule on drawings for size and capacity per tank.
- J. Provide vacuum breaker on discharge pipe for each fiberglass softener tank.
- K. Brine Tank: High density polyethylene tank with a non-degradable salt platform. See schedule on drawings for size of brine tank.

5.11 CONTROL (TYPICAL EACH RESIN TANK): ALTERNATING, FULLY PROGRAMMABLE, PROGRESSIVE FLOW DESIGN. BRASS, PISTON OPERATED MULTI-CYCLE CONTROL VALVES FOR METER INITIATED REGENERATION.

- A. Meter: Bronze construction, transmitting low voltage signal to controller.
- B. Test Kit: Provide water testing kit to make chemical tests necessary for controlling operation and adjustments of brine dosage.
- C. Sediment Filter: Furnish and install a "Spin-Down" reusable screen filter, 2" in size with ball type drain valve. Similar to Rusco Inc. "Sediment-Trapper"
- D. Softening Capacity: See schedule on plumbing drawings.

5.12 SOFTENER INSTALLATION

- A. Coordinate with plumbing piping and related electrical work to achieve a complete operating system.
- B. Install drain piping to nearest floor drain.
- C. Resin tank and brine tank(s) shall be installed on 4" high concrete pad, unless noted otherwise.
- D. On Inlet:
 - 1. Strainer.
 - 2. Pressure gage.
 - 3. Shut-off valve.
- E. On Outlet:
 - 1. Shut-off valve.
 - 2. Pressure gage.
 - 3. Flow meter
- F. Contractor shall provide initial salt fill, start water softening system and instruct owner in proper operation and maintenance of unit.

5.13 IN-LINE WET-ROTOR CIRCULATING PUMPS

- A. Manufacturer: Bell and Gossett, Grundfos, Taco, Patterson.
- B. Type: Circulator Pump, Maintenance Free, Wet Rotor, Inlet/Outlet Union, Housing Material Bronze, Max. Temp. 225 F, Max. Working Pressure 150 PSI, Shut-Off @ 15 Ft., Impeller Material Noryl, Thermal Protection, Warranty Length 3 Years.
- C. Housing Material : Bronze, Max. Temp. (F) : 225, Max. Working Pressure (PSI) : 150, Impeller Material: Noryl, Shaft Material : Compliance: Certified For Use In Potable Water Applications.
- D. Motor: Provide pump with impedance protected motor sized for non-overloading over the entire pump curve. Pump shall be single phase power unless otherwise indicated, Furnish, each pump and motor with a nameplate giving the manufacturer's name, serial number of pump,

RQAW Corporation
Wheatland Wastewater

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capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed
and full load current.

E. Pump: Size and capacity as indicated on drawings, see Pump Schedule.

5.14 CONDENSATE PUMPS

A. Manufacturer: Little Giant – Model VCMA-15ULT

B. Designed for the automatic collection and removal of condensate from HVAC equipment.

5.15 GALLON ABS COLLECTION TANK.

5.16 AUTOMATIC START AND STOP OPERATION.

5.17 FLOAT ACTIVATE SWITCH.

5.18 POWER: 115 VOLT, 1.0 AMP, 60 WATTS, 6 FOOT LONG, 3-CONDUCTOR POWER CABLE WITH GROUNDED 3-PRONG PLUG.

5.19 MOTOR: 1/50 HP

5.20 DISCHARGE: 3/8" OD BARBED FITTING.

5.21 COVER CONSTRUCTION – ABS

5.22 CHECK VALVE.

5.23 FLOW: 30.0 GPM @ 9 FT. OF HEAD

5.24 DOMESTIC WATER BOOSTER PUMPS (ALTERNATE, IF REQUIRED)

5.25 SET DISCHARGE PRESSURE OF PUMP TO 65.0 PSI

5.26 ESTABLISH 50.0 PSI DELIVERY PRESSURE TO MOST REMOTE AREA.

5.27 SIZE AND CAPACITY AS INDICATED ON PUMP SCHEDULE, SEE DRAWINGS.

5.28 LOW SUCTION PRESSURE SWITCH AND ALARM.

5.29 SHUTOFF VALVE ON PUMP SUCTION AND DISCHARGE.

5.30 PRESSURE TANK SHALL BE SHIPPED LOOSE AND CONNECTED AS SHOWN ON DRAWINGS.

5.31 MAIN POWER DISCONNECT.

5.32 SINGLE POINT ELECTRICAL CONNECTION.

5.33 24V DC POWER SUPPLY

5.34 SUCTION AND DISCHARGE PRESSURE TRANSDUCERS

5.35 CAPABLE OF COMMUNICATION WITH BUILDING MMS BY COMMUNICATIONS PROTOCOL.

5.36 DATA LOGGING.

A. General: Factory packaged simplex domestic water booster pump with all components fully frame mounted, piped, painted, wired and tested at factory. ANSI/NSF61 certified by CSA.

B. Type: Vertical in-line stainless steel, multi-stage pump, 300 psig maximum working pressure at operating temperature of 250oF. continuous. The manufacturer shall certify all pump ratings. Pump to operate without excessive noise or vibration.

C. Shafts: Stainless with tungsten steel sleeve, ceramic bearings.

D. Seals: Mechanical type, carbon rotating against a stationary elastomer, 250°F maximum continuous operating temperature.

E. Manifold Piping: Stainless steel 304 piping, schedule 10 or heavier pipe as required to maintain a 3 to 1 safety factor. Final connections to assembly shall be made with flexible suction and discharge braided pipe connectors, suction and discharge pressure gauges and common thermal relief valve piped to floor drain.

F. Controls: Current sensing control mounted in UL 508A listed, labeled NEMA 1 control panel with the following components: magnetic across the line motor starters with 3 leg overload

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protection and external resets, starter failure interlocks, H-O-A switches for each pump, single door interlocked disconnect with individual fuses, control circuit transformer with protected secondary, time delays, minimum run timers, adjustable solid state current sensing relays, low suction pressure cutout, pump 1 & 2 automatic alternation, high suction pressure shutdown, 2 sensor differential temperature no-flow shutdown, operating and warning lights, warning alarm. Controller shall have a three phase lightning surge arrester.

- G. Start-Up: A qualified factory trained certified technician shall perform initial factory start-up and owner training. A factory start-up report must be provided to the owner, dated and signed by the factory technician. Provide 24/7/365 factory certified field service during the warranty period.
- H. Factory packaged single domestic water booster pump assembly with all components fully frame mounted, piped, painted, wired and tested at factory.
- I. Type: The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.
- J. Tank: Booster system shall include a bladder tank for no-flow shutdown.
- K. Impellers: Stainless steel, provide internal thrust balance in each stage.
- L. Motors: Provide pump with open drip-proof motor sized for non-overloading over the entire pump curve. Furnish pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.
- M. Expansion Tank: Furnished by the pump manufacturer.

5.37 SIMPLEX PUMP: MINIMUM TANK VOLUME = 25.0

5.38 DUPLEX PUMPS: MINIMUM TANK VOLUME = 53.0

5.39 DOMESTIC WATER EXPANSION TANKS

- A. Manufacturer: Bell and Gossett, Wessels, Watts.
- B. Vertical steel pre-charged, diaphragm expansion tank, 125 psi ASME labeled construction, complete with replaceable flexible butyl rubber bladder, system connection fitting, Schrader type air charge fitting, steel base ring stand, factory prime and enamel painted exterior finish, ASME relief valve. Materials exposed to water to be NSF or FDA approved for potable water service. Size as indicated on plumbing schedule, see drawings.
- C. NOTE: Tanks over 5.0 gallons of volume shall be placed on wall mounted shelf, furnished and installed by the contractor.

5.40 THERMOSTATIC MIXING VALVES

- A. TMV-1: High/Low Master Manifold System: Provide lead-free, factory assembled and tested thermostatic high-low valves, constructed of bronze body and cap with replaceable corrosion and lime resistant components, including universal mounting capability, equipped with integral check-stops, removable strainers, liquid-filled thermostat with 10 year warranty, dial thermometer.

5.41 PROVIDE WALL MOUNTING BRACKET.

5.42 MINIMUM FLOW: 0.5 GPM

5.43 MANUFACTURERS: LAWLER (SERIES), POWERS (HYDROGUARD X-P).

- A. Manufacturers: Lawler (Series 66), Watts, Powers.

PART 3 - EXECUTION

6.01 INSTALLATION

- A. Install plumbing equipment where indicated in accordance with manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

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- B. Set commercial water heaters, water softeners, and booster pumps (IF REQUIRED) on 4" high concrete housekeeping pads. Adjust and level equipment.
- C. Connect equipment to water and drain piping using unions or flanges and isolation valves.
- D. Size temperature and relief valves per CSA ratings. Route Piping of temperature and pressure relief valves to terminate over nearest floor drain or floor as indicated.
- E. Startup and test equipment adjusting operating and safety controls for proper operation.
- F. Cycle softeners and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc. Provide initial salt fill of brine tank.
- G. Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.
- H. Adjust compression tank pre-charge to scheduled minimum operating pressure prior to connecting to system.

END OF SECTION

**SECTION 224000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

- A. Work of this Section includes, but is not limited to:
1. Inclusion of all plumbing fixtures, complete and ready for use. All fixtures, except as otherwise specified, shall be constructed of vitreous china with all visible exposed surfaces glazed.
 2. Providing all stops, traps, escutcheons, connections, etc., as are necessary to complete the installation of each fixture, whether such items are listed or not.
 3. Plumbing Trim: All finished exposed faucets, traps, connecting piping, stops, flush valves and other fixture trim shall be chromium-plated brass unless otherwise specified and shall be supported rigidly to fixtures and to walls with matching brackets at not more than 2'-0" center. All fastenings shall be chromium-plated brass or may be 302 stainless steel if of matching color and finish. Faucets shall be furnished as required. Vacuum breakers shall be provided as a part of the fixture trim wherever there is a possibility of back-siphoning.
 4. Fixture Stops: Shut-offs for urinal and water closet flush valves shall be an integral part of the fixture or fitting; shut-offs for all other fixtures shall be loose-key, lock-shield-type. All fixture stops shall be angle- or straight-type adapted for each particular location and shall be located immediately adjacent to the fixture. Use threaded adaptors when used in conjunction with copper tube work.
 5. All exposed screws or fasteners for plumbing fixtures and faucets shall be vandalproof. Contractor shall take care to coordinate this item with his suppliers prior to Shop Drawings submittal.
 6. Aerators, where required for sinks and lavatories shall be vandalproof type.
 7. ADA Showers: Threshold of shower shall not exceed 1/2" for transfer showers, 1/4" for roll-in showers. It is the Contractor's responsibility to set the floor level of the shower to meet this requirement. Floors may be required to have a recess area to set shower unit.
 8. Showers: All showers to be provided with proper studding to secure unit to walls. The space between the bottom of the unit and the sub-floor must be filled with bedding compound to secure and level the unit. Bedding compound shall be Gold Bond Gypsolite Plaster, US Gypsum Structo-Lite Plaster or a thin mortar mix.
 9. Sinks: Contractor shall verify the physical size of each specified sink with the proposed sink cabinet and countertop. See Architectural and Interior's design drawings for ADA required fixtures.

1.03 QUALITY ASSURANCE

- A. Meet the requirements of the following:
1. State Plumbing Code.
 2. State Department of Housing, Buildings and Construction.
- B. Material Standards
1. ANSI/ASME A112.19.2-90: Vitreous China Plumbing Fixtures.
 2. ANSI/ASME A112.19.3-87: Stainless Steel Plumbing Fixtures (Designed for Residential Use).
 3. ANSI/ASME A112.19.M-94: Porcelain Enameled Formed Steel Plumbing Fixtures.
 4. ANSI/ASME A112.19.5-79: Trim for Water Closet Bowls, Tanks, and Urinals.
 5. ANSI/ASSE 1016-90: Performance Requirements for Thermostatic, Pressure Balancing and Combination Control Valves for Bathing Facilities.

6. ANSI/ASSE 1025-78: Performance Requirements for Diverters for Plumbing Faucets with Hose Spray, Anti-Siphon-Type, Residential Applications.

1.04 SUBMITTALS

- A. Shop Drawings: Required for review.
- B. Product Data: Catalog cuts, including all fixture trim.
- C. Samples: Not required for review.
- D. Project Information: Not required for review.
- E. Contract Close-Out Information: Operating and maintenance data, Guarantees

PART 2 PRODUCTS

2.01 SEE PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR ADDITIONAL FIXTURES TYPES AND MODEL NUMBERS.

2.02 MATERIALS - GENERAL

- A. Acceptable Manufacturers
 1. Plumbing Faucets: American Standard, Sloan, Kohler, Delta, and Moen.
 2. Flush Valves: Sloan and Zurn.
 3. Vitreous China Plumbing Fixtures: American Standard, Kohler and Zurn.
 4. Mop Sinks: Fiat, Stern Williams and Mustee
 5. Water Closet Seats: Church, Bemis, Beneke, and Centoco.
 6. Shower Mixing Valves: Powers, Commercial Delta, Lawler, and Bradley.
 7. Stainless Steel Sinks: Elkay, Just.
 8. Prefabricated Showers: Aquarius, AquaBath, Clarian.
 9. Fixture Carriers: Josam, J.R. Smith, Watts and Zurn.
 10. Emergency Eye Wash/Showers: Haws and Bradley.
- B. Plumbing Fixtures – General: Constructed or equipped with anti-siphon devices to prevent siphoning waste material into potable water supply system.
- C. Escutcheons and Plates: Conceal all holes where pipes pass through walls, floors or ceilings; use plates or escutcheons.
- D. Piping Exposed in Finished Areas (including fittings and trim): Chromium-plated or nickel-plated brass with polished bright surface.
- E. Trim for Lavatories and Sinks: Provide with renewable cartridges.
- F. Vitreous Caps: Provide for water closet bolts.
- G. Sealant: Silicone-type. See Division 07 Section “Joint Sealants”.
- H. Sinks: Shall be 18 gauge 304 stainless steel with Satin finish. Verify with architectural and interior design drawings ADA requirements.
- I. Mop Sinks: Molded Stone construction, 3” internal drain with faucet, hose bracket, mop hanger bracket and stainless steel wall guard.
- J. Disposals: Continuous feed with galvanized steel grinding elements and self-service wrench. Verify with cabinet size physical clearances.
- K. ADA Sinks: Waste outlets for all ADA sinks shall be 90 degree offset grid drain similar to Elkay LK235L

2.03 INSULATION AT HANDICAPPED LAVATORIES

- A. Handicapped lavatories exposed waste, hot and cold water supply lines shall be insulated with a molded, flexible vinyl insulation system with all fasteners. Provide insulation for 1-1/4-inch waste offset drain, tailpiece, P-trap and waste arm and 3/8-inch supply tubing and 3/8-inch keyed stop valve. Color shall be as selected by the A/E.
- B. Insulation shall comply with ASTM E84 25/450, flame spread index of not more than 25 and a smoke-developed index of not more than 450.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Sink manufacturer shall provide proper template to architectural woodwork supplier for cutting of countertop. Plumber shall place sink in countertop and complete faucet and piping.
- B. Install all fixtures in accordance with Manufacturer's recommendations.
- C. Contractor shall coordinated ADA required fixtures and sinks with architectural and interior design drawings.
- D. All fixture support carriers shall be of the type necessary to permit adjustment to fit variations in construction. All grounds or special supports necessary for setting fixtures shall be provided before plastering or other finished construction work is begun. All fixtures shall be hung at standard height unless otherwise indicated by the A/E.
- E. Minimum fixture connection sizes are shown on the Drawings.
- F. Provide fixture carriers and required drainage fittings on all wall hung fixtures. Anchor carriers securely to floor.
- G. Where plumbing fixtures abut to walls, floors, and countertops, seal all joints with sealant.
- H. Seal Mop Sinks to wall and floor with building sealant.
- I. Provide anchors behind the wall for flush valve supply piping.
- J. Adjust self-sustaining closet seats for proper operation and to sustain in any position.
- K. Adjust electric water coolers flow for correct operation and temperature.
- L. Insulate the hot and cold water and waste piping under handicapped lavatories.
- M. Adjust shower mixing valves for correct leaving water temperature (115 deg.) unless otherwise noted.
- N. Coordinate electrical requirement of Kitchen Disposals with electrical contractor.
- O. After all fixtures have been set and are ready for use, and before the Contractor leaves the job, he shall thoroughly clean all fixtures furnished and set by him, removing all stickers, rust stains and any other matter or discoloration of fixtures, leaving every part in new condition. He shall, further, adjust all flush valves and other fixture water tempering or balancing at supplies to give proper water flow of fixtures.

END OF SECTION

SECTION 23 00 00

COMMON REQUIREMENTS OF HVAC

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the general requirements applicable to all Heating, Ventilation, and Air Conditioning work.
- B. Provide complete and fully operational HVAC systems controlled as indicated in the construction documentation.
- C. The construction documents are comprised of both specifications and construction drawings. Information pertinent to design intent may be included in either or both locations, which create one set of contract documents.

1.2 DEFINITIONS

- A. Basis of Design: Equipment and materials identified in the drawing schedules, notes, and specifications and identified as a specific product or example represents the intended Basis of Design. Any equipment or materials provided by the Contractor must meet or exceed the performance quality of the Basis of Design.
- B. Substitution: Any equipment or material which is not the Basis of Design.
- C. General Requirements: The provisions set forth in the Division 01 sections apply to the entire work of the contract and other elements which are included in the project. Basic contract definitions are in the General Conditions.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels generally considered normally occupiable by people.
- E. Exposed, Interior Installations: Installed indoors and exposed to viewing by people. Examples included finished spaces and mechanical rooms equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view but outside the building envelope and therefore exposed to weather and ambient conditions. Examples include roof top locations.
- G. Concealed, Interior Installations: Installed within the building envelope, but concealed from view. Examples include those items installed within walls, above ceilings, below floors, or in chases.
- H. Concealed, Exterior Installations: Installed outside of the building envelope, but concealed from view and protected from weather conditions by a secondary structure, but subject to outdoor ambient conditions. Examples include installations within enclosures that are not heated or cooled.

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- I. Indicated: Implication of a cross reference to a graphic representation, note, schedules, or other specification section or another area within the contract documents. The terms “shown”, “noted”, “scheduled”, and “specified” are used as synonyms to “indicated”. No limitation of cross reference location is intended except as specifically noted.
- J. Furnish: Supply and deliver to project site, ready for unloading, unpacking, assembly, installation and similar operations. Where “furnish” applies to work for which the installation is not otherwise specified, “furnish” shall mean “furnish and install”.
- K. Install: Operations at the project site including “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operation.
- L. Provide: To furnish and install complete and ready for intended use.

1.3 SUBMITTALS

- A. Action Submittals: These submittals are required to be returned with no exceptions prior to procuring or installing products or materials. The Submittal Review process is described in Section 01.
 - 1. Work Plans: Written Narrative of the work plan used to create the schedule. Coordinate with other trades and contractors to develop required work plans as required to develop the long term coordinated construction schedule.
 - 2. Product Data: Providing information on the actual product selection intended for use as specified in other Division 23 Specifications and the Construction Documents. All product data submittals shall clearly identify the product to be used subject to rejection.
 - 3. Shop Drawings: Providing information on the actual installation methodology to be used to install items as specified in other Division 23 Specifications and the Construction Documents
- B. Informational Submittals: These submittals are intended to facilitate coordination and construction phasing and scheduling. These submittals will not be returned unless non-conformance with the contract documents is noted.
 - 1. Construction Schedules: Schedule of work showing percent completion of milestones in the work plan. Coordinate with the general contractor, owner, or owner’s representative, to develop, maintain, and regularly update the construction schedule as required
 - 2. Coordination Documents: Drawings including Plans, Sections, Elevations, localized infrastructure crossing details, drawn to scale, on which the items below have been included utilizing information from all trades, contractors, and installers:
 - a. Building Structure and structural supports and attachments for piping, ductwork, lighting fixtures, cables, cable trays, raceways and conduit.
 - b. Building Roofs, walls, floors, windows, doors, and ceilings
 - c. Suspended Ceilings components
 - d. HVAC Equipment, piping, ductwork, controls devices, and associated electrical disconnects.
 - e. Size and Location of access doors and panels required for maintenance of products installed in walls and inaccessible ceilings.
 - f. Size and Location of penetrations through the finished floor.
 - g. Size and Location of penetrations through fire rated walls.

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- h. Items penetrating the finished ceiling, including but not limited to:
 - 1) Air outlets and inlets
 - 2) Luminaires
 - 3) Fire Suppression Sprinklers
 - 4) Fire Alarm Components, such as horns and strobes
 - 5) Life Safety Components, such as exit signs
 - 6) Mass Notification Components, such as speakers
 - 7) IT components, such as routers
 - 8) Security components, such as cameras
 - 9) Service Access Panels

- C. Substantial Completion Submittals: These submittals are required prior to achieving substantial completion from the Architect or Engineer of Record. One hard copy shall be turned over to the Owner's Maintenance Staff at Owner Training.
 - 1. Record Drawings Submittal reviewed with "No Exceptions" by Architect and/or Engineer of record.
 - 2. Commissioning Documentation as required by other specification sections provided in .PDF file format on a USB Thumb-drive and one printed copy organized by specification section in multiple three ring binders not to exceed 4", including at minimum:
 - a. Start Up Reports for all HVAC Equipment and components.
 - b. Testing, Adjusting and Balancing report returned with "No Exceptions" by the Architect and/or Engineer of record.
 - c. Manufacturer's Operation and Maintenance Data for all HVAC system Products, including all accessory sizes required, such as belt and filter sizes and types.
 - d. Emergency Service Contact including Name, email address, and Phone Number.
 - e. Written Record from Owner stating Owner's Representative system training has been successfully delivered.
 - 3. Service Valve Tag Chart and Location Maps.
 - 4. Updated Control Valve Schedule.
 - 5. Field Reports indicating successfully completing Ductwork Leakage Testing.
 - 6. Field Reports indicating successfully completing Piping Pressure Testing.
 - 7. Any and all maintenance required items as specified in other Division 23 Sections in packages with protective cover for storage and identified with labels describing contents and intended use. (i.e. FAN BELT – AHU-1 SUPPLY FAN)

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Where feasible, arrange for product delivery to the construction site when construction has progressed to allow for delivery to the final installed location protected from the weather and site security is sufficient to prevent easy theft (lockable door, container, or cage area and/or a night guard).

- B. Deliver all pipes with factory applied end caps. Caps shall be maintained through shipping and storage until such time pipe is being installed to prevent entrapment of debris and contaminants and minimize pre-construction corrosion of materials.

- C. Do not allow any materials to be stored exposed to weather, standing water, excessive dirt and dust, or in a manner to prevent the flow of traffic through the worksite.

- D. Handle all products with care and per manufacturer’s written instructions for lifting and rigging. Do not install damaged items without written consent from the Owner.

1.5 COORDINATION

- A. The drawings indicate the general arrangement, routing, and scope of the systems and are to be followed as often as possible. Deviations from the drawn layout are permissible, if necessitated by field conditions and approved by the Architect or Engineer of Record through submittal and properly coordinated with all other trades.
- B. The drawings are not intended to show every minor vertical and/or horizontal offset required to navigate a complete installation of the system due to obstructions that may arise due to field conditions. Contractors shall anticipate potential additional offsets in their construction proposals.
- C. The drawings, schedules, and specifications shall be considered one cooperative document. Items may or may not appear in both drawings and specifications. Anything appearing in one or the other location shall be considered included in the contract documents and the contractor shall provide a bid based inclusive of both Specifications and Drawings. Any and all identified conflicting statements between the Specifications and Drawings that affects the final bid price shall be submitted for clarification during the bidding process.
- D. New Equipment: All equipment provided by the contractor shall be provided as “new” and not “used”. Contractor shall not energize equipment prior to substantial completion unless:
 - a. Factory Representative and/or Owner’s Representative is in attendance for start-up testing.
 - b. The Test, Adjusting and Balancing Contractor is actively testing the equipment
 - c. Specific, written authorization from the Owner has been granted for:
 - i. Space Pressurization in conjunction with approved pressurization plan.
 - ii. Space Tempering during finish installation.
- E. Contractor shall field verify all measurements in the field and shall be responsible for the correct fitting of all systems and components. Contractor shall coordinate all work with other branches and trades to minimize conflict and delays. Contractors shall:
 - a. Coordinate work plan in advance with all other trades and immediately upon discovery, report any anticipated difficulty with proposed resolutions to the general contractor and/or Architect or Engineer of Record.
 - b. Provide the General Contractor and Owner with a detailed schedule to be incorporated within the overall construction schedule to include at minimum:
 - i. Any necessary demolition, as phased by floor and area.
 - ii. Temporary Construction as required to maintain any existing services.
 - iii. Coordination Efforts
 - iv. Architectural Rough Ins – i.e. wall and floor sleeves installation.
 - v. Product Submittals
 - vi. Shop Drawing Submittals
 - vii. Product Procurement and storage

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- viii. Product Installation
 - ix. Duct and Piping Installation
 - x. Installation of Insulation and Identification Systems
 - xi. Start-Up and Commissioning of Equipment
 - xii. Owner Training
 - xiii. Punch List Inspection
 - xiv. Substantial Completion
- c. Coordinate space needs of ductwork, piping, chases, wall, floor, and roof penetrations, with other trades during construction to allow for easy installation.
 - d. Coordinate installation of all structural supporting elements, sleeves, sleeve seals, etc. through cast-in-place concrete and other structural components as they are constructed.
 - e. Coordinate requirements for all access hatches, panels, doors, hand holes for HVAC items during work planning for wall and ceiling construction. Access panels and doors are specified in Division 08.
 - f. Coordinate any and all trenching, excavating, bedding, and backfilling with general contractor and appropriate piping specifications and earthwork specifications in other divisions.
 - g. Coordinate any HVAC Demolition with all aspects of demolition and temporary construction by other trades, including dust barriers and electrical demolition. Do not remove electrical components of HVAC equipment without electrical components first being locked out and removed by Division 26 demolition contractor.
- F. Existing Conditions: For renovation of existing facilities which are occupied:
- a. Do not interrupt the utilities serving existing facilities while occupied or partially occupied without coordinated arrangement for temporary utilities according to the requirements listed and written approval from the Owner.
 - i. Do not proceed with proposed utility interruptions without permission from the Owner.
 - ii. Submit a utility outage plan for approval by the Owner no less than seven (7) days prior to include, at minimum:
 - 1. Utilities to be disrupted.
 - 2. Length of disruption.
 - 3. Plan for Fire Watch
 - b. Coordinate installation of new products and systems with all existing installations which are existing to remain in the project area, including but not limited to:
 - i. Plumbing, including domestic water, sanitary waste and vent piping and storm drain piping.
 - ii. Fire protection and suppression piping.
 - iii. HVAC Service Piping, including heating, cooling, condenser, steam, condensate, compressed air, and refrigerant piping.
 - iv. Piping Expansion Fittings
 - v. Ductwork
 - vi. Electrical Conduit, Cable Tray, Raceway
 - vii. Lighting Fixtures and Luminaires

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- viii. Existing IT Infrastructure, including wireless routers, cabling, and wire trays.
 - ix. Existing Security Infrastructure, including cameras, and door contactors and operators
 - x. Existing Fire Alarm and Life Safety Infrastructure, including smoke and fire detectors, annunciators, strobe lights, exit signs, and extinguishers.
- c. Provide Shop Drawings for all connections to existing systems including transitions in ductwork and pipe fittings.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance requirements, provide a product from one of the listed manufacturers. Any manufacturer specifically mentioned on the drawing shall be considered Basis – of – Design.
- B. Available or Acceptable Manufacturers: Manufacturers of known equivalence. When listed, provide a product by one of the manufacturers listed or submit a non-listed manufacturer’s product for review. Contractor is responsible for all cost deviations arising from use of a non-listed manufacturer.

2.1 ELECTRICAL REQUIREMENTS

- A. Electrical Characteristics for HVAC Equipment: Unless otherwise approved, supply equipment with the electrical characteristics as indicated in the contract documents.
- B. Equipment with electrical characteristics different from those indicated in the contract documents shall only be supplied if the following is approved in writing:
 - a. The electrical supply wiring and conduit size is properly coordinated and modified.
 - b. The electrical over-current protection device is properly coordinated and modified.
 - c. The changes associated with panelboards, local transformers, and disconnects are properly coordinated and modified.
 - d. Any additional costs of other contractors associated with the change in electrical characteristics are the responsibility of the Mechanical Contractor

2.2 PIPE, TUBE, AND FITTINGS

- A. See Section 231113 Hydronic Piping and 231116 Hydronic Piping Specialties
- B. See Section 232300 Refrigerant Piping

2.3 DUCTWORK

- A. See Section 233100 HVAC Ducts and Casings and 233300 Duct Accessories

2.4 GROUT

- A. Description: ASTM C 1007B, nonshrink and nonmetallic, dry hydraulic-cement grout
 - a. Post Hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications
 - b. 5000-PSI, 28-day compressive strength

2.5 JOINING MATERIALS

- A. Refer to Division 23 Piping Sections for special joining materials not listed below. When joining materials are in conflict, utilize the joining materials specified in the piping specific application specification.
- B. Pipe-Flange Gasket Materials: Suitable chemical and thermal conditions for the specific use of the piping as specified in other Division Piping Sections
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless otherwise indicated
 - i. Full-Face: Flat-Face, Class 125, cast-iron and cast-bronze flanges
 - ii. Narrow-Face: Raised-Face, Class 250, cast-iron and steel flanges
 - b. AWWA C110, rubber, flat face, 1/8-inch-thick, full face or ring type, unless otherwise indicated
- C. Flange Bolts and Nuts: ASME B182.1, Carbon Steel, unless otherwise indicated
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material as recommended by piping system manufacturer for intended service, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys with ASTM B 813 water flushable flux. Melting point suitable for service.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorous alloys for general-duty brazing, unless otherwise indicated.
 - a. Refrigerant Piping Brazing Filler Metals: AWS A5.8, Bagl, Silver alloy, unless otherwise specified by the manufacturer's written installation instructions.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for the wall thickness and chemical composition of the steel pipe being welded.
- H. Solvent Cements for Plastic Pipe
 - a. PVC Piping:
 - i. Solvent Cement: ASTM 2564
 - ii. Primer: ASTM F 6565
 - b. CPVC Piping:
 - i. Solvent Cement: ASTM 493

PART 3 - EXECUTION

3.1 PRE-WORK INSPECTION

- A. Examine the work area before beginning installation. Ensure
 - a. Conditions are safe and satisfactory for working.
 - b. Rough-In work is installed properly.

- c. All coordination activities are successfully completed.
- d. The area is free of conflicts to proper installation.

B. Do not proceed with work if conditions are unsatisfactory.

3.2 PLANNING

- A. Plan work beforehand.
- B. Communicate work plan to other contractors performing work in the area
- C. Coordinate all work as listed in the Coordination Section of this specification.

3.3 INSTALLATION

- A. Install mechanical items in accordance with the contract documents and manufacturer's published installation instructions.

3.4 CONCRETE BASES

- A. Anchor equipment to concrete base according to equipment manufacturer's published installation instructions and in accordance with seismic requirements, if present.
- B. Construct concrete bases of dimensions indicated, but not less than 6 inches larger than supported unit in all directions.
- C. Install dowel rods 18 inches on center to connect concrete base to concrete floor.
- D. Install epoxy-coated anchor bolts for supported equipment that extends through the concrete base and anchor to structural floor.
- E. Place and secure anchorage devices using supported equipment manufacturer's published documentation, including setting drawings, diagrams, templates, instructions furnished with equipment to be supported.
- F. Use 3000 PSI 28-day compressive strength concrete and reinforcements as specified in Division 03.
- G. Ensure anchor bolts have proper exposed elevation to properly secure equipment to base.

3.5 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surface, pump, and other equipment base plates, and anchors.
- B. Clean all surfaces to be grouted prior to installing grout.
- C. Provide forms as needed to properly install grout.

- D. Place grout, completely filling bases and forms.
- E. Avoid entrapment of air within the grout during installation.
- F. Place grout on concrete bases and provide smooth and level bearing surfaces for equipment to be supported
- G. Place grout around anchors.
- H. Cure placed grout.

3.6 METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 for structural steel requirements.
- B. Metal Channel (“strut”) products in accordance with the Metal Framing Manufacturer’s Association standards may be used for metal framings, supports, and anchorages.
- C. Cut, fit, and place miscellaneous metal supports accurately in locations as needed, with proper alignment and elevation required to support and anchor HVAC materials and equipment as intended in the contract documents.
- D. Field Welding shall comply with AWS D1.1

3.7 WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages as needed to support and anchor HVAC equipment and materials.
- B. Select fasteners that will not penetrate wood members through a finished or exposed side. Tighten connections between members. Do not install fasteners resulting in split or weakened wood members.
- C. Attach to substrates as required to support the sum of the dead load and applied working load of supported equipment.

3.8 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

- A. Contractor shall confirm proper fit of equipment.
- B. Install equipment level and plumb.
- C. To the extent possible, install equipment and products perpendicular and parallel to exterior walls unless otherwise indicated.
- D. Install equipment perpendicular and parallel to other building systems and components unless otherwise indicated.

- E. Install all HVAC products and equipment:
 - a. To maximize headroom if specific mounting height is not specified.
 - b. To facilitate maintenance and service.
 - c. To maintain manufacturer's recommended minimum clearances.
 - d. To meet NFPA 70 required clearances to electrical components.
 - e. To allow space for installation of necessarily sloped items at intended slope.
- F. Connect equipment for ease of disconnecting and removing, with minimum interference to other installations
- G. Extend grease fittings to accessible locations outside of motor compartments and equipment casings.

3.9 CLEANING AND RESTORATION

- A. Contractor shall repair damage resulting from the contractor's work.
- B. Leave the work area broom clean at the end of each work shift.
- C. Thoroughly clean the work area at the completion of construction. At a minimum, Contractor shall:
 - a. Remove all excess grout, paint, plaster, caulk, firestopping, or other products used during installation of HVAC systems from finished surfaces.
 - b. Clean duct systems clear of construction debris and dust.
 - c. Clean the blowers, fan housings, discharge plenums, scrolls, blades, vanes, shafts, baffles, dampers, and drive assemblies of all air handling units and fans free of construction debris and dust.
 - d. Clean all coils dust free and render Coil Visibly Clean and within 10% of design coil pressure drop.
 - e. Clean all drain pans free of debris and dust.
 - f. Clean all dust from diffusers, registers, and grilles.
 - g. Clean, empty, and replace all strainer baskets.
 - h. Clean debris from all insect and bird screens.
 - i. Install new, clean air filters.
 - j. Remove all trash from mechanical equipment rooms.
 - k. Sweep clean all mechanical rooms.
 - l. Remove dust from exposed equipment casings.
 - m. Ensure all equipment tags and labels are clean and legible.

3.10 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to start up, test, and inspect mechanical equipment components, assemblies, connections, and installations as indicated.

- B. Non-Conforming Work: Items shall be deemed defective if they do not pass tests and inspections, including commissioning functional testing.

3.11 FIELD PAINTING

- A. When field applied coatings are specified, painting of HVAC Systems, equipment, and components is specified in Division 09.
- B. Damage and Touchup: Marred, scratched, dinged, or otherwise damaged factory finishes shall be repaired with materials to match original factory finish using the manufacturer's approved methods.

3.12 OWNER TRAINING

- A. Contractor shall provide training to the Owner's maintenance personnel on the systems and equipment installed. Training shall include, at a minimum:
 - a. Means of turning equipment on and off safely.
 - b. Review of Equipment Sequences and Operation.
 - c. Review of Equipment Capacities and Capabilities.
 - d. Means of making minor adjustments to setpoints.
 - e. Review of Building Automation Systems.
 - f. Basic Maintenance requirements.
 - i. Filter Change Parameters and procedures.
 - ii. Fan Belt Change Procedures.
 - iii. Bearing Grease extension locations.
 - iv. Greasing Intervals.
 - v. Strainer cleaning procedures and intervals.
 - vi. Turnover of Substantial Completion Hard Copy.

END OF SECTION 230000

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.
- B. Related Sections:
 - 1. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 2. Section 260553 - Identification for Electrical Systems.

1.2 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Action Submittals:
 - 1. Product Data:
 - a. Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, maintenance procedures and intervals, and support points.
 - b. Submit data for each motor furnished as a package with the package submittal. Indicate nameplate and performance data, standard compliance, electrical ratings and characteristics and maintenance procedures and intervals.
 - 2. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

C. Information Submittals:

1. Motor Manufacturer's published Operation and Maintenance Data, to be included in close out submittals.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Testing Agency: Company specializing in testing products specified in this section with minimum three <3> years' documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Product storage and handling requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.
- C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.
- D. For extended outdoor storage, remove motors from equipment and store separately.

1.6 COORDINATION

- A. Coordinate all features of motors, installed units, and accessory devices to be compatible with:
 1. Means of Motor Starting.
 2. Torque, speed, and mechanical power requirements of the application.
 3. Ratings and characteristics of the electrical supply circuit.
 4. Means of speed control.
 5. Ambient and environmental conditions, both during storage and in the final installed location.
- B. Coordinate all motor installation requirements with Division 26 contractor.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

- A. Motors 1/2 hp and Larger: Three-phase motor as specified below.
- B. Motors Smaller Than 1/2 hp: Single-phase motor may be supplied as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.

- C. Three-Phase Motors: NEMA MG 1, Design B, premium-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
 - 1. Voltage: As indicated on Drawings
 - 2. Service Factor: 1.15
 - 3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings.
 - 4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 - 5. Design Code: Design B
 - 6. Insulation System: NEMA Class F.
 - 7. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
 - 8. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
 - 9. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
 - 10. Sound Power Levels: Conform to NEMA MG 1.

- D. Single Phase Motors:
 - 1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
 - 2. Voltage: as indicated on the drawings, single phase, 60 Hz.

- E. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 THREE-PHASE MOTORS FURNISHED LOOSE

- A. Acceptable Manufacturers: Acceptable Manufacturer's are listed below. Other manufacturers of equivalent products may be submitted for review.
 - 1. General Electric
 - 2. Siemens
 - 3. Baldor
 - 4. Marathon Electric Company

- B. Product Description: NEMA MG 1, Design B, premium-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds indicated.

- C. Voltage: as indicated on the drawings, three phase, 60 Hz.

- D. Service Factor: 1.15

- E. Enclosure: Meet conditions of installation unless specific enclosure is specified or indicated.
- F. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- G. Insulation System: NEMA Class F.
- H. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- I. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
- J. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- K. Sound Power Levels: Conform to NEMA MG 1.
- L. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.3 SOURCE QUALITY CONTROL

- A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned motors
- B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Clean and repair existing motors to remain or are to be reinstalled.

3.2 INSTALLATION

- A. Install securely on firm foundation. Mount ball bearing motors in accordance with motor manufacturer's requirements.
- B. Install engraved plastic nameplates in accordance with Section 260553 for all motors.

- C. Electrical Installer shall provide and install all necessary materials and labor to ground and bond motors in accordance with Section 260526.

3.3 FIELD QUALITY CONTROL

- A. Perform inspections listed in NETA ATS, Section 7.15 for Rotating Machinery.
- B. Perform Insulation Resistance Testing on all motor installations for the nominal voltage rating of the equipment. Motors that do not meet the minimum insulation resistance value tabulated in ANSI/NETA ATS-2009, summarized below, shall be reworked or replaced until the motor passes testing.

Nominal Rating of Equipment (volts)	Minimum Test Voltage, DC	Minimum Insulation Resistance in Megohms
<250	500	25
250 < Rated Volts < 600	1,000	100

END OF SECTION 230513

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet metal ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Rectangular duct connection systems.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Requirements

1. ANSI/SMACNA 006-2006 (SMACNA 006) HVAC Duct Construction Standards – Metal and Flexible Third Edition. All ductwork shall be in conformance with this standard.
2. Structural Performance: Duct hangers, supports, and seismic restraints (where applicable) shall withstand the effects of gravity, wind, and seismic loads and stresses within limits and under conditions described in SMACNA 006, ASCE/SEI 7, and local requirements.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.2 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by the Architect/Engineer. Accompany requests for layout modifications with calculations showing the proposed layout will provide original design results without increasing system total pressure.

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: For each type of the following products:
 - a. Prefabricated ductwork and fittings.
 - b. Liners and adhesives.
 - c. Rectangular duct connection systems.
 - d. Sealants and gaskets.

2. Shop Drawings:
 - a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - b. Fittings, including details of construction.
 - c. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - d. Elevations of top and bottom of ducts along with applicable elevations of structural elements.
 - e. Dimensions of main duct runs from building grid lines.
 - f. Reinforcement and spacing.
 - g. Duct material and gauge thickness by pressure class.
 - h. Seam and joint construction.
 - i. Penetration details through fire-rated, smoke barriers and other rated partitions.
 - j. Equipment installation based on equipment being utilized on this project.
 - k. Duct accessories, including dampers, turning vanes, and duct access doors.
 - l. Length of application of acoustic duct liner where it will be applied.
 - m. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
 - n. Other systems installed in the same space as ducts where order of installation affects access.
 - o. Ceiling and wall mounted access doors and panels required to provide access to dampers, controls and other operating devices.
 - p. Ceiling mounted items, including light fixtures, diffusers, grilles, speakers, smoke detectors, sprinklers, other electrical devices, equipment and building structural members.
 - q. On each drawing, include a tabular list of each fan system's ductwork represented on that drawing and the total square foot surface area of each fan's duct system illustrated on the drawing.
 - r. Shop drawings shall be submitted prior to the fabrication or installation of the ductwork and serve as the foundation for coordination between various trades to maintain required ceiling heights.
3. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Failed test results and corrective action taken to achieve requirements.

- B. Leakage Testing Documentation: Contractor shall submit a written report to the authority having jurisdiction in which ducts designed at static pressures more than 3" wg pressure class have been leak tested and that the air leakage class is less than 6.0 per the Energy Code. Provide duplicate submittal to the Owner and the Engineer.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for steel hangers and supports.

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2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum hangers and supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance: Applicable requirements in:

1. NFPA 90A.
2. NFPA 90B.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1.

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Damage: Handle, transport, and store ducts to avoid damage. Damaged ductwork is not acceptable.
- B. Protection: Protect ducts from mechanical damage, weather, and exposure to chemicals (including road salt). Do not permit insulation materials to get wet under any circumstances. Remove insulation that is or has been wet from the project site, and replace the insulation with undamaged new materials.
- C. Ductwork and associated components shall be stored on blocking in a clean dry area to prevent damage and to prevent the entrance of dirt, debris, foreign matter and moisture.
- D. Ductwork shall be adequately supported during storage to prevent sagging or bending.
- E. Provide temporary storage, delivery and handling in accordance with SMACNA Duct Cleanliness for New Construction Guidelines, Intermediate Level.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA 006 based on indicated static-pressure class. The figure numbers below reference that standard.
 1. Transverse Joint: Figure 2-1.
 2. Longitudinal Seam: Figure 2-2.
 3. Pressure Class Gage and Reinforcement: Table 2-1 through Table 2-52 and Figure 2-3 through Figure 2-18.
 4. Elbow: Figure 4-2 (Use the following types only unless specifically approved by the Engineer.):
 - a. Type RE 1 (radius elbow).

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- b. Type RE 2 (square throat elbow with turning vanes).
 - c. Type RE 3 (radius elbow with vanes).
 - d. Type RE 5 (dual radius elbow).
 - e. Type RE 6 (mitered elbow without turning vanes) only for angles not greater than 45 degrees.
5. Turning Vanes: Figures 4-3 and 4-4. Figure 4-9 short radius vanes in accordance with Chart 4-1 are acceptable.
 6. Branch Connection:
 - a. Diverging Flow: Figure 4-5 (all types). Figure 4-6 (following types only):
 - 1) 45-degree entry to rectangular branch.
 - 2) 45-degree lead-in to round branch.
 - 3) Conical connection.
 - 4) Bellmouth connection.
 - 5) Conical or bellmouth spin-in fitting only for pressure class 2" WG or less.
 - b. Converging Flow: Figure 4-5 (all types) and Figure 4-6 (all types). Conical or bellmouth spin-in fitting is acceptable only for pressure class 2" WG or less.
 7. Offset, Transition, or Obstruction: Figure 4-7 (all types) and Figure 4-8 (Figure B and C). Do not use Figure 4-8 Figure A (pipe through duct), Figure D (mitered offsets around obstruction, or Figure E (split duct around obstruction) unless specifically approved by the Engineer.

2.2 SINGLE-WALL ROUND OR FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA 006 Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - a. Eastern Sheet Metal.
 - b. FlaktGroup SEMCO.
 - c. Lindab Inc.
 - d. McGill AirFlow LLC.
 - e. Sheet Metal Connectors, Inc.
 2. Transverse Joint: Figure 3-1 (all types).
 3. Longitudinal Seam: Figure 3-2 (all types). Do not use type RL-5 (grooved seam pipe lock or flat lock), RL-6 (snaplock), RL-7 (snaplock), or RL-8 (snaplock) seam for duct over 1" WG pressure class. Fabricate round duct larger than 90-inch diameter with butt-welded longitudinal seam.
 4. Pressure Class Gage and Reinforcement: Table 3-2 through Table 3-15 and Figure 3-3.
 5. Elbow: Figure 3-4. Use centerline radius of 1.5 diameters for each elbow unless space constraints prevent a radius that large; in that event, the radius may be reduced to that indicated in Table 3-1 with mitered segments. If space constraints prevent a radius as

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- large as indicated in Table 3-1, a mitered elbow with turning vanes similar to Figure 4-3 and Figure 4-4 may be used. Do not use an adjustable elbow for duct over 1" WG pressure class.
6. Branch Connection with Diverging or Converging Flow: Figure 3-5 and Figure 3-6. All types are acceptable for pressure class 2" WG or less duct. For pressure class 3" WG or more duct, use 90-degree tee fitting with oval-to-round tap, 45-degree lateral fitting, conical fitting, or wye fitting. Reducers may be incorporated into the fitting. Use only factory-fabricated fittings, not saddles or field-fabricated taps, for pressure class 3" WG or more duct.
 7. Offset, Transition, or Obstruction: Figure 4-7 and Figure 4-8 modified for round or flat oval duct. Do not use Figure 4-8 Figure A (pipe through duct), Figure D (mitered offsets around obstruction), or Figure E (split duct around obstruction) unless specifically approved by the Engineer.
 8. Flat Oval: Figure 3-7 and applicable figures for equivalent round duct.

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA 006 for material thicknesses and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 1. Galvanized Coating Designation: G90 unless otherwise indicated.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- D. Reinforcement Shapes and Plates:
 1. Steel Duct: ASTM A 36/A 36M, steel plates, shapes, and bars; black or galvanized.
 2. Aluminum Duct: ASTM B209 alloy 6061-T6 members or steel members isolated from the aluminum with butyl rubber, neoprene, or EPDM gasket materials.
 3. Other Duct Materials: Reinforcement materials compatible with the duct materials at contact points.
- E. Tie Rods: Materials compatible with duct materials. Galvanized steel or stainless steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, and NAIMA AH124.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - a. Owens Corning.
 - b. CertainTeed Corporation: Insulation Group.
 - c. Johns Manville.
 - d. Knauf Insulation.
2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy and registered by the EPA for use in HVAC systems.
4. Surface-Burning Characteristics: Flame-spread index no greater than 25 and smoke-developed index no greater than 50 when tested according to UL 723; certified by a nationally recognized testing laboratory.
5. Water-Based Liner Adhesive: Comply with NFPA 90A and with ASTM C 916.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - a. Aeroflex USA Inc.
 - b. Armacell LLC.
 - c. Rubatex International, LLC.
2. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

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3. Surface-Burning Characteristics: Flame-spread index no greater than 25 and smoke-developed index no greater than 50 when tested according to UL 723; certified by a nationally recognized testing laboratory.
 4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A. For indoor applications, adhesive with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, or stainless steel (as appropriate); with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- D. Shop Application of Duct Liner: Comply with SMACNA 006 Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not install liner in rectangular ducts with longitudinal liner joints at locations other than corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Lined duct following unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are 2500 fpm or more.
 - d. Other locations as indicated.
 9. Terminate liner with buildouts (metal hat sections) at dampers, turning vane assemblies, or other devices. Secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 RECTANGULAR DUCT CONNECTION SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
1. Ductmate Industries, Inc.
 2. Hart & Cooley, Inc. Ward Industries.
 3. McGill Airflow LLC.
- B. Connection System: Rectangular duct transverse joint connection, reinforcement, and sealing system with roll-formed metal flanges, metal corner pieces, sealants, gaskets, and cleats.

2.6 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a flame-spread index no greater than 25 and a smoke-developed index no greater than 50 when tested according to UL 723; certified by a nationally recognized testing laboratory.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Sealant: Modified styrene acrylic.
 3. Water resistant.
 4. Mold and mildew resistant.
 5. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 6. Service: Indoor and outdoor.
 7. Service Temperature: Minus 40 to plus 200 deg F.
 8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 9. For indoor applications, sealant with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). For school projects, sealant complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). For school projects, sealant complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts or other materials compatible with duct materials.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods; galvanized rods with threads painted with zinc-chromate primer after installation; or stainless steel all-thread rods and nuts.

C. Strap and Rod Sizes: Comply with SMACNA 006 Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Cables:

1. Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
2. Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
3. End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

- F. Trapeze and Riser Supports: Structural shapes and plates of materials compatible with duct materials and environmental conditions. Support material shall match duct construction material.

2.8 CASINGS

- A. Fabricate casings according to SMACNA 1966 and construct for indicated operating pressures.
- B. Doors:
 - 1. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles.
 - 2. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection.
- C. Casings:
 - 1. Fabricate acoustic casings with reinforcing turned inward.
 - 2. Furnish 18-gage back facing and front facing.
 - 3. Construct panels 3 inches thick and packed with 4.5-pcf minimum glass-fiber media, on 16-gage inverted channels.

2.9 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Ductmate Industries, Inc.
 - 3. Hilti Corp.
 - 4. Kinetics Noise Control.
 - 5. Mason Industries.
 - 6. TOLCO; a brand of NIBCO INC.
 - 7. Unistrut Corporation; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts

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designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION GENERAL REQUIREMENTS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
 - 1. Supply ducts (before air terminal units): 4-inch wg.
 - 2. Supply ducts (after terminal units): 2-inch wg.
 - 3. Supply ducts (inside shafts): 6-inch wg.
 - 4. Return and outside air ducts (in mechanical equipment rooms and inside shafts) (negative pressure): 4-inch wg.
 - 5. Return ducts (above ceiling): 2-inch wg.
 - 6. General exhaust ducts (negative pressure): 2-inch wg.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction losses for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings or Coordination Drawings.
- C. Install ducts according to SMACNA 006 unless otherwise indicated.
- D. Unless otherwise indicated, install ducts vertically plumb or horizontally level, and parallel and perpendicular to building lines. Avoid diagonal runs to maximum extent possible.
- E. Install ducts with a minimum clearance of 2 inch plus allowances for insulation thickness and access requirements.
- F. Cable hangers may only be used on low pressure (2" wg construction and lower) round spiral ductwork which is not insulated and has a diameter 10" or less. Utilize the double lock method such that the lower loop is clinched tight to the ductwork and the cable is vertical. Utilize manufacturer's top attachment device.
- G. Provide duct offsets needed to avoid interferences with structure, finishes, piping, other ducts, conduit, etc. Coordinate the work with all trades to minimize such offsets. Install ducts with fewest joints possible.

- H. Do not penetrate ducts with conduit or piping.
- I. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- J. Secure couplings with sheet metal screws. Install screws at maximum intervals of 12", with a minimum of 3 screws in each round metallic duct coupling.
- K. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections. Do not field-cut taps for branch connections in ducts with SMACNA pressure class magnitude more than 2 in wg.
- L. Install round or flat-oval ducts in maximum practical lengths to minimize joints.
- M. Do not install any duct in an electrical equipment room unless that duct serves that room.
- N. Do not install any duct in an elevator equipment room unless that duct serves that room.
- O. Do not install any duct over an electrical transformer, electrical switchgear, or an electrical panel unless approved in writing by the Engineer.
- P. Maintain clearances required in the National Electric Code for electrically-powered items.
- Q. Where ducts pass through interior partitions or exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal type and thickness as the duct. Overlap openings on all sides by at least 1-1/2 inches.
- R. Where ducts pass through fire-rated partitions, install fire dampers unless otherwise indicated. Comply with requirements in other Division 23 Sections for fire dampers.
- S. Where ducts pass through smoke partitions, install smoke dampers unless otherwise indicated. Comply with requirements in other Division 23 Sections for smoke dampers.
- T. Install ductwork takeoffs at smoke dampers such that there is a minimum of 24" between the damper and the start of the first takeoff.
- U. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts that are to be exposed in finished spaces from damage including dents, surface scratches, and markings. Exposed ducts must be undamaged and present a clean, neat appearance in materials and workmanship.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system in finished spaces.

- C. Grind welds to provide smooth surfaces free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets and inlets.
- E. Repair or replace ducts that do not comply with these requirements.

3.3 DUCT SEALING

- A. In accordance with ASHRAE 90.1, seal all ducts to SMACNA 006 seal class A with all transverse joints, longitudinal seams, and duct wall penetrations sealed. Seal openings for rotating shafts (including dampers) with bushings or other devices. However, do not seal an opening if sealing the opening would void a manufacturer's listing. Spiral lock seams in round or flat oval ducts do not require sealing unless leakage is detected.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA 006 Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

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4. Do not use powder-actuated concrete fasteners for seismic restraints.

- C. Hanger Spacing: Comply with SMACNA 006 Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

- D. Hangers Exposed to View: Threaded rod and angle or channel supports. Other types of hangers may be used if so indicated or if approved by Engineer.

- E. Vertical Ducts: Support vertical ducts with steel angles or channel secured to the sides of the ducts with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet.

- F. Upper Attachments: Install upper attachments secured to structural members. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials. Do not attach duct supports to roof decks.

- G. Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, conduit, and piping

3.5 CONNECTIONS

- A. Make connections to motorized equipment with flexible connectors complying with other Division 23 Sections. Comply with SMACNA 006 for branch, outlet, inlet, and terminal unit connections.

3.6 CASINGS

- A. Floor Mounting:
 1. Install on 4 -INCH high concrete curbs as specified in Section 033000 - Cast-in-Place Concrete.
 2. At floor, rivet panels to angles 8 inches o.c.
 3. If floors are acoustically insulated, provide liner of 18-gage supported 12 inches o.c. and turned up 12 inches sides with sheet metal shields

3.7 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA "Seismic Restraint Manual: Guidelines for Mechanical Systems" or ASCE/SEI 7.
 1. Space lateral supports a maximum of 40 feet on center and longitudinal supports a maximum of 80 feet on center.
 2. Brace changes of direction longer than 12 feet (or less if local requirements indicate a shorter length).

- B. Select seismic-restraint devices with capacities adequate to carry static and seismic loads.

- C. Install cables so they do not bend across edges of adjacent items.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to building structural members such as flanges of beams, upper truss chords of bar joists, or concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, conduit, and piping.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeves fully engaged in the structural elements to which anchors are to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.8 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a primer compatible with the duct material.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

1. Comply with SMACNA "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test ductwork sections that have a design static pressure class magnitude of 4-inch wg or more regardless of duct locations. Test representative duct sections totaling no less than **25** percent of total installed duct area. Obtain Engineer's approval of specific sections to be tested beforehand.
 3. Test all ductwork located outdoors.
 4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 5. Test for leaks before applying external insulation.
 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 7. Give at least seven days notice for testing.
 8. Tests must demonstrate that tested ducts meet SMACNA leakage class 4 or less. If any tested section of ductwork fails to meet this requirement, perform the following at no additional cost to the Owner:
 - a. Leak test 100 percent of the ductwork in every duct system with any failed section.
 - b. Provide additional sealing of ductwork to eliminate excessive leakage in failed sections. If necessary, replace duct sections.
 - c. Retest 100 percent of the ductwork in every duct system with any failed section.
 - d. Continue sealing and retesting until the entire system is proven to meet the leakage requirement. Note that once a section is proven to meet the leakage requirement that section does not need to be tested again unless it is damaged later.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.10 DUCT CLEANING

- A. Clean duct system(s) before testing, adjusting, and balancing in accordance with other Division 23 Sections.

3.11 DUCT CONSTRUCTION REQUIREMENTS

- A. Fabricate ducts with materials, pressure classes, and insulations indicated on Drawings.

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END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Manual volume dampers.
 2. Ceiling radiation dampers.
 3. Flange connectors.
 4. Turning vanes.
 5. Duct-mounted access doors.
 6. Duct access panel assemblies.
 7. Flexible connectors.
 8. Duct accessory hardware.

1.2 SUBMITTALS

- A. Action Submittals:
1. Product Data: For each type of product.
 - a. For ceiling dampers include installation instructions.
- B. Closeout Submittals:
1. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.
- C. Maintenance Material Submittals:
1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 2. Fusible Links: Furnish quantity equal to at least 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A and NFPA 90B.

- B. Comply with SMACNA 006 for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or Type 316 as indicated. Unless indicated otherwise, No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - 1. Ruskin Company.
 - 2. American Warming and Ventilating.
 - 3. Greenheck Fan Corporation.
 - 4. McGill Airflow LLC.
 - 5. Nailor Industries Inc.
 - 6. NCA.
 - 7. Pottorff.
 - 8. Safe Air – Dowco Products.
 - 9. Vent Products Co., Inc.
- B. Round Manual Volume Damper: Diameter 20 inches or less, air velocity 1500 fpm or less, and duct static pressure class 2-inch or less. Galvanized steel sleeve with reinforcing beads. Single galvanized steel blade on axle with molded synthetic bearing at each end of axle and locking quadrant on standoff bracket. Basis of design Ruskin MDRS25.
- C. Round or Oval Manual Volume Damper: Diameter 48 inches or less, air velocity 4000 fpm or less, and duct static pressure class 10-inch or less. Galvanized steel construction for galvanized steel duct. Type 304 stainless steel construction for type 304 stainless steel or aluminum duct.

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Type 316 stainless steel construction for type 316 stainless steel duct. Rolled hat channel frame arranged for slip-in mounting. Single blade (or dual blades with center mullion for oval duct over 36 inches wide). Neoprene blade edge seals. Class II leakage rating. Blade mounted on axle with stainless steel sleeve bearing at each end of axle and locking quadrant on standoff bracket. Basis of design Ruskin CDR25 or CDO25.

- D. Rectangular Manual Volume Damper: Height 12 inches or less, air velocity 1500 fpm or less, and duct static pressure class 1-inch or less. Galvanized steel sleeve with blade stop. Single galvanized steel blade on axle with molded synthetic bearings and locking quadrant on standoff bracket. Basis of design Ruskin MD25.
- E. Rectangular Manual Volume Dampers: Height 5 inches or more, air velocity 1500 fpm or less., and duct static pressure class 3-inch or less. Galvanized steel hat channel frame with mitered and welded corners and blade stop. Flanged for attaching to wall and flangeless for installing in duct. Multiple single-thickness formed galvanized steel blades with opposed blade linkage enclosed in frame. Blades mounted on axles with molded synthetic bearings. Control shaft extended beyond frame with locking quadrant on standoff bracket. Basis of design Ruskin MD35.

2.4 CEILING RADIATION DAMPERS

- 1. Ruskin Company CFD series.
- 2. American Warming and Ventilating.
- 3. Nailor Industries Inc.
- 4. NCA.
- 5. Pottorff.
- 6. Safe Air – Dowco Products.

B. General Requirements:

- 1. Labeled according to UL 555C.
- 2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F or 212 deg F rated, fusible links.

F. Fire Rating: 1, 2, or 3 hours as indicated.

2.5 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - 1. Ductmate Industries, Inc.
 - 2. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA 006.
- D. Vane Construction: Single wall for vanes up to 48 inches wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA 006. Double wall, rectangular door. Galvanized sheet steel with insulation fill and thickness as indicated for duct pressure class. Butt or piano hinges and cam locks, quantities as indicated in SMACNA 006. Doors airtight and suitable for duct pressure class. Galvanized sheet steel frame with bend-over tabs and foam gaskets. Vision panel where indicated.
- B. Pressure Relief Access Door: Door and frame of galvanized sheet steel. Double wall door with insulation fill and metal thickness applicable for duct pressure class. Open outward for positive-pressure duct and inward for negative-pressure duct. Factory set at 3.0-inch to 8.0-inch wg positive or negative. Door retaining device. Neoprene or foam rubber seal.

2.8 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - 1. Ductmate Industries, Inc.
 - 2. Approved equal.
- B. Labeled according to UL 1978. Double-wall panel with two layers of steel, minimum 11 gage (0.12-inch thick) carbon or 11 gage (0.13-inch) stainless, steel type to match duct material. Carbon or stainless steel panel fasteners welded to inner wall and attached by threaded fasteners to outer wall. Fasteners shall not penetrate duct wall. Gasket complying with NFPA 96; grease-tight and airtight, high-temperature ceramic fiber, rated for minimum 2000 deg F. Minimum pressure rating 10-inch wg, positive or negative.

2.9 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene. Minimum weight 26 oz./sq. yd. Minimum tensile strength 480 lbf/inch in the warp and 360 lbf/inch in the filling. Service temperature range minus 40 to plus 200 deg F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone. Minimum weight 24 oz./sq. yd. Tensile strength 530 lbf/inch in the warp and 440 lbf/inch in the filling. Service temperature range minus 50 to plus 250 deg F.

2.10 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories in accordance with manufacturers' instructions.
- B. Install duct accessories according to applicable details in SMACNA 006 for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- C. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- D. Compliance with ASHRAE/IESNA 90.1 restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft or control damper (as indicated) at inlet of exhaust fan or in exhaust duct close to exhaust fan unless otherwise indicated.
- E. Install volume dampers only in ducts constructed to magnitude 2" pressure class or less. Provide at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- F. Set each damper fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coil.
 - 2. Upstream and downstream from duct filter.
 - 3. At outdoor-air intake and mixed-air plenum.

4. At drain pan.
 5. Downstream from manual volume damper, control damper, backdraft damper, and equipment.
 6. Upstream and downstream from duct silencer.
 7. At each control device requiring inspection.
 8. Elsewhere as indicated.
- I. Install access door with swing against duct static pressure.
- J. Access Door Sizes:
1. One-Hand or Two-Hand Access: 12 by 12 inches.
 2. Head and Hand Access: 18 by 12 inches.
 3. Head and Shoulders Access: 24 by 18 inches.
 4. Body Access: 30 by 18 inches.
 5. Body plus Ladder Access: 30 by 30 inches.
 6. Where duct width does not permit door size specified above, one dimension of door size may be reduced to 2 inches less than duct width.
- K. Label access door as specified in another Division 23 Section to indicate the purpose of the access door.
- L. Install flexible connectors to connect ducts to equipment. If vibrating equipment is internally isolated from casing, provide rigid duct connections.
- M. For fan developing static pressure of 5-inch wg or more, cover flexible connector with loaded vinyl sheet held in place with metal straps.
- N. Connect terminal unit to supply ductwork directly or with maximum 12-inch length of flexible duct. Do not use flexible duct to change directions or to correct misalignment of duct and terminal unit inlet.
- O. Connect diffuser or register to duct directly or with maximum 60-inch length of flexible duct clamped or strapped in place.
- P. Connect flexible duct to metal duct with liquid adhesive plus tape.
- Q. Install duct test hole where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate each damper to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed and that door can open fully.
3. Inspect turning vanes for proper and secure installation.
4. Operate remote damper operator to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.

1.2 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevation.
- B. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - a. Certified fan performance curves with system operating conditions indicated.
 - b. Certified fan sound-power ratings.
 - c. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - d. Material thickness and finishes, including color charts.
 - e. Dampers, including housings, linkages, and operators.
 - f. Roof curbs.

B. Informational Submittals:

1. Field quality-control reports.

C. Closeout Submittals:

1. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

D. Maintenance Material Submittals:

1. Belts: One spare set for each belt-driven unit.

1.4 QUALITY ASSURANCE

- A. AMCA Compliance:
 - 1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
 - 2. Operating Limits: Classify according to AMCA 99.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. New York Blower Company.
 - 4. PennBarry.
 - 5. Twin City Fan & Blower.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
 - 1. Downblast Units: Provide spun-aluminum discharge baffle to direct discharge air downward.
 - 2. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Direct Drive (Where Applicable): Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Belt Drives (Where Applicable):
 - 1. Resiliently mounted to housing.
 - 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 4. Pulleys: Cast-iron, adjustable-pitch motor pulley. Spring-loaded idler pulley for automatic belt tensioning.
 - 5. Fan and motor isolated from exhaust airstream.

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F. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or stainless steel wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base. Self-flashing without a cant strip configuration, with mounting flange.

1. Overall Height: 18 inches unless indicated otherwise.
2. Sloped Roof Mounting (Where Applicable): Manufacture curb for roof slope.
3. Burglar Bars: 1/2-inch-thick steel bars welded in place on 6-inch centers both directions.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors as indicated on Drawings and specified in another Division 23 Section. Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301. Factory test fans according to AMCA 300. Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210. Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans and accessories in accordance with manufacturer's instructions.
- B. Install power ventilators level and plumb.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. Coordinate roof curb installation with General Contractor.
- E. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 2 inches specified in another Division 23 Section.
- F. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

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- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Verify that shipping, blocking, and bracing are removed.
 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 3. Verify that cleaning and adjusting are complete.
 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 5. Adjust belt tension where applicable.
 6. Adjust damper linkages for proper damper operation.
 7. Provide and verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

END OF SECTION 23 34 23

EXTRUDED ALUMINUM STATIONARY LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Extruded aluminum stationary louvers with drainable blades.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete.
- B. Section 04200 - Masonry Units.
- C. Section 05100 - Structural Metal Framing.
- D. Section 06100 - Rough Carpentry.
- E. Section 07600 - Flashing and Sheet Metal.
- F. Section 07920 - Joint Sealants.
- G. Section 09910 - Paints.

1.3 REFERENCES

- A. AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels.
- B. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- C. AMCA 511 - Certified Ratings Program for Air Control Devices.

1.4 SUBMITTALS

- A. Comply with requirements of Section 01330 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data including performance data.
- C. Shop Drawings: Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.
- D. Samples: Submit sample of louver to show frame, blades, bird screen, gutters, downspouts, vertical supports, sill, accessories, finish, and color.

1.5 QUALITY ASSURANCE

System Improvements Division
MECA Certified Ratings Seal
Performance and water penetration ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finishes during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Ruskin Manufacturing
- B. Arrow
- C. Cesco
- D. Greenheck
- E. Pottorff
- F. Approved Equal

2.2 EXTRUDED ALUMINUM STATIONARY LOUVERS

- A. Fabrication:
 - 1. Performance Ratings: AMCA licensed.
 - 2. Frame:
 - a. Material: Extruded aluminum, Alloy 6063-T5.
 - b. Wall Thickness: 0.125 inch (3.2 mm), nominal.
 - c. Depth: 6 inches (152 mm).
 - d. Downspouts and caulking surfaces.
 - 3. Blades:
 - a. Style: Drainable.
 - b. Material: Extruded aluminum, Alloy 6063-T5.
 - c. Wall Thickness: 0.125 inch (3.2 mm), nominal.
 - d. Angle: 37.5 degrees.
 - e. Centers: 5-29/32 inches (150 mm), nominal.
 - 4. Bird Screen:

System Improvements Division 1 - Waste Water Treatment Plant and Lift Station
Aluminum, [Expanded, flattened] [1/2 inch mesh x
0.063 inch (13 mm mesh x 1.6 mm), intercrimp].

- b. Frame: Removable, rewireable.
 - 5. Gutters: Drain gutter in head frame and each blade.
 - 6. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
 - 7. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches (3,048 mm).
 - 8. Sill: Steeplly angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
 - 9. Assembly: Factory assemble louver components. All welded construction.
- B. Design Load: Incorporate structural supports required to withstand wind load of 20.

2.3 ACCESSORIES

- A. Bird Screens:
- B. Insect Screens:
- C. Extended Sills: Extruded aluminum, Alloy 6063-T5. Minimum nominal wall thickness 0.060 inch (1.5 mm).
- D. Visible Mullions: Manufacturer's standard horizontal or vertical visible mullions for architectural accent as indicated on drawings.

2.4 FACTORY FINISH

- A. Color Anodize Finish:
 - 1. Comply with Aluminum Association AA-C22A44.
 - 2. Apply finish following chemical etching and pretreatment.
 - 3. Electrolytically deposited color anodized finish.
 - 4. Minimum Thickness: 0.7 mils (0.018 mm).
- B. Clear Anodize Finish:
 - 1. Comply with Aluminum Association AA-C22A31. Clear anodize finish 204-R1.
 - 2. Apply finish following chemical etching and pretreatment.
 - 3. Minimum Thickness: 0.4 mils (0.01 mm), 30 minute anodizing process.

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PART 5 - EXTERIOR SYSTEMS
Extruded Aluminum Stationary Louvers Division 1 – Wastewater Treatment Plant and Lift Station

3.1 EXAMINATION

- A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.
- B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.
- C. Install joint sealants as specified in Section 07920.

3.3 CLEANING

- A. Clean louver surfaces in accordance with manufacturer's instructions.
- B. Repair minor damaged surfaces as directed by Architect.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Action Submittal:

1. Product Data: For each product indicated, include the following:
 - a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - b. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
2. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Ceiling suspension assembly members.
 - b. Method of attaching hangers to building structure.
 - c. Size and location of initial access module for acoustical tile.
 - d. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - e. Duct access panels.
3. Color Samples for Initial Selection: For each product with factory-applied color finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
1. Titus.
 2. Price.
 3. Krueger.
 4. Hart & Cooley.

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5. Metalaire.
6. Tuttle & Bailey.
7. AJ Manufacturing.
8. Gordon INC.

B. See drawing schedules, plans and details for required materials, finishes, style, sizes , pattern performance and accessories.

1. Internal insulation of slot diffuser plenums is not allowed. All slot diffuser plenums shall be externally insulated.

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Provide sponge rubber gasket, mounting frame, and concealed fastener mounting on all surface mounted grilles and registers.
- E. Paint inside portion on all ductwork and plenums visible behind air device non-specular flat black enamel.
- F. Provide additional support for grilles, registers, and diffusers mounted in lay-in ceiling.
- G. Provide non-specular flat black steel blank-offs behind all unused portions of linear air devices.
- H. Coordinate exact location of Diffusers, Grilles and Registers with area smoke detectors, lights, and electrical devices. Air devices shall not be closer than 3 feet from area smoke detector.
- I. Final location of diffusers, registers and grilles shall be from architectural reflected ceiling plans.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 81 26 – SPLIT AC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes single zone and multi-zone split systems with matched variable speed condensing units.

1.2 DEFINITIONS

- A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.
- B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

1.3 SUBMITTALS

- A. Action Submittals:

- 1. Product Data: For each type of product include:

- a. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units.
 - b. Rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - c. Operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
 - d. Description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
 - e. System operating sequence of operation in narrative form for each unique indoor- and outdoor-unit.
 - f. Description of control software features.
 - g. Total refrigerant required, and a comprehensive breakdown of refrigerant required by each system installed.
 - h. Refrigerant type and data sheets showing compliance with requirements indicated.
 - i. System design software information.
 - j. Indication of location and type of service access.

- 2. Shop Drawings: For ductless split systems.

- a. Include plans, elevations, sections, and mounting attachment details.
 - b. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

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- c. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - d. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
 - e. Include diagrams for power, signal, and control wiring.
3. Samples for Initial Selection: For fully and partially exposed indoor units with factory finishes viewable by occupants. Include a sample for each unique finish with unit identification, detailed description of application, and cross-referenced floor plans showing locations.

B. Informational Submittals:

1. Qualification Data:

- a. For Installer: Certificate from ductless split system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation. Retain copies of Installer certificates on-site and make available on request.
 - b. For ductless split system manufacturer.
 - c. For ductless split system provider.
2. Seismic Qualification Data: Certificates, for equipment, accessories, and components, from manufacturer.
- a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
3. Source quality-control reports.
4. Field quality-control reports.
5. Sample Warranties: For manufacturer's warranties.

C. Closeout Submittals:

1. Operation and Maintenance Data: For ductless split systems to include in emergency, operation, and maintenance manuals.
2. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.

3. Extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Filters: One set for each unit.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of ductless split systems and products.
2. Shipped ductless split systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. Ductless split systems and products that have been successfully tested and in use in at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. ISO Compliance: System equipment and components furnished by ductless split system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, ductless split system manufacturer.
2. Demonstrated experience on projects of similar complexity, scope, and value. Each person assigned to Project shall have demonstrated experience.
3. Service and maintenance staff assigned to support Project during warranty period.
4. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by ductless split system manufacturer.

1. Each Installer certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.

F. ASHRAE Compliance: Comply with applicable requirements in:

1. ASHRAE 15.
2. ASHRAE 62.1.
3. ASHRAE/IES 90.1.
4. ASHRAE 135: For control network protocol with remote communication.

- G. UL Compliance: Comply with UL 1995.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in a clean and dry place.
- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit. Remove and replace products that are wet, moisture damaged, or mold damaged.
- E. Replace installed products damaged during construction.
- F. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressors: 10 years from date of Substantial Completion.
 - b. For Parts, Including Controls: 10 years from date of Substantial Completion.
 - c. For Labor: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - 1. Carrier / Toshiba
 - 2. Daikin AC (Americas), Inc.
 - 3. Lennox
 - 4. LG

5. Panasonic
6. Samsung.
7. York, a Johnson Controls company.

2.2 SYSTEM DESCRIPTION

- A. Direct-expansion (DX) ductless split system with variable capacity in response to varying cooling and heating loads. System shall consist of outdoor unit with single or multiple indoor units. Provide all piping, controls, and electrical power to make complete operating systems complying with requirements indicated.
 1. System operation, air-conditioning, or heat pump as indicated.
 2. Each system with one refrigerant to each indoor unit connected to system.

2.3 PERFORMANCE REQUIREMENTS

- A. System Design and Installation Requirements:
 1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
 2. Where manufacturer's requirements differ from requirements indicated, contact Engineer for direction. The most stringent requirements should apply unless otherwise directed in writing by Engineer.
- B. Isolation of Equipment: Provide isolation valves to isolate each indoor unit for service, removal, and replacement without interrupting system operation.
- C. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the range of not less than 50 percent to not more than 150 percent of outdoor-unit rated capacity or greater range if acceptable to system manufacturer.
- D. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.
- E. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.
- F. Outdoor Conditions:
 1. Suitable for outdoor ambient conditions encountered.
 - a. Design equipment and supports to withstand snow and ice loads of governing code and ASCE/SEI 7.
 - b. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.
 2. Maximum System Operating Outdoor Temperature: See Drawings.
 3. Minimum System Operating Outdoor Temperature: See Drawings.

- G. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.
 - 1. Indoor: Within design guidelines of "2015 ASHRAE HANDBOOK- HVAC Applications."
 - 2. Outdoor: Within ordinance of governing authorities.
- H. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

2.4 INDOOR, EXPOSED, WALL-MOUNTED UNITS

- A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
- B. Cabinet:
 - 1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
 - 2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
 - 3. Mounting: Manufacturer-designed provisions for field installation.
 - 4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. DX Coil Assembly:
 - 1. Coil Casing: Aluminum, galvanized, or stainless steel.
 - 2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
 - 3. Coil Tubes: Copper, of diameter and thickness required by performance.
 - 4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
 - 5. Unit Internal Tubing: Copper tubing with brazed joints.
 - 6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
 - 7. Field Piping Connections: Manufacturer's standard.
 - 8. Factory Charge: Dehydrated air or nitrogen.
 - 9. Testing: Factory pressure tested and verified to be without leaks.
- D. Drain Assembly:
 - 1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
 - 2. Condensate Removal: Gravity. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.
 - 3. Field Piping Connection: Non-ferrous material.
- E. Fan and Motor Assembly:
 - 1. Fan(s):

- a. Direct-drive arrangement.
 - b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
 - c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
 - d. Wheels statically and dynamically balanced.
2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
 3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
 4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
 5. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Filter Assembly:
1. Access: Front, to accommodate filter replacement without the need for tools.
 2. Efficiency: ASHRAE 52.2, MERV 8.
 3. Media: Replaceable extended surface, panel, or cartridge with antimicrobial treatment fiber media.
- G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern mounted in top or front face of unit cabinet.
- H. Unit Accessories:
1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
 2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.
- I. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
 2. Factory-Installed Controller: Configurable digital control.
 3. Factory-Installed Sensors:
 - a. Unit inlet air temperature.
 - b. Coil entering refrigerant temperature.
 - c. Coil leaving refrigerant temperature.
 4. Features and Functions:

- a. Self-diagnostics.
 - b. Time delay.
 - c. Auto-restart.
 - d. Auto operation mode.
 - e. Manual operation mode.
 - f. Filter service notification
 - g. Power consumption display.
 - h. Drain assembly high water level safety shutdown and notification.
 - i. Run test switch.
5. Communication: Network communication with other indoor units and outdoor unit(s).
 6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- J. Unit Electrical:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
 2. Field Connection: Single point connection to power entire unit and integral controls.
 3. Disconnecting Means: Factory-mounted circuit breaker or switch.
 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 6. Raceways: Enclose line voltage wiring in metal raceways.

2.6 OUTDOOR, AIR-SOURCE HEAT-PUMP UNITS

- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with either all heating or all cooling demands, but not for use in systems with simultaneous heating and cooling.
 2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
 3. All units installed shall be from the same product development generation.
- B. Cabinet:
1. Galvanized steel and coated with a corrosion-resistant finish. Coating with documented salt spray test performance of 1000 hours according ASTM B 117 surface scratch test (SST) procedure.
 2. Mounting: Manufacturer-designed provisions for field installation.
 3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressors with inverter drive and turndown to 15 percent of rated capacity.
2. Protection: Integral protection against the following:
 - a. High refrigerant pressure.
 - b. Low oil level.
 - c. High oil temperature.
 - d. Thermal and overload.
 - e. Voltage fluctuations.
 - f. Phase failure and phase reversal.
 - g. Short cycling.
3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.
6. Crankcase heaters with integral control to maintain safe operating temperature.

7. Fusible plug.
- D. Condenser Coil Assembly:
1. Plate Fin Coils:
 - a. Casing: Aluminum, galvanized, or stainless steel.
 - b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
 - c. Tubes: Copper, of diameter and thickness required by performance.
 2. Aluminum Microchannel Coils:
 - a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
 - b. Single- or multiple-pass arrangement.
 - c. Construct fins, tubes, and header manifolds of aluminum alloy.
 3. Corrosion Protection: Coating with documented salt spray test performance of 1000 hours according ASTM B 117 surface scratch test (SST) procedure.
 4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
- E. Condenser Fan and Motor Assembly:
1. Fans: Propeller type.
 - a. Direct-drive arrangement.
 - b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
 - c. Dynamically balanced.
 2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
 3. Motors: Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
 4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
 5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
 6. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.
- G. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.

2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:
 - a. Refrigerant suction temperature.
 - b. Refrigerant discharge temperature.
 - c. Outdoor air temperature.
 - d. Refrigerant high pressure.
 - e. Refrigerant low pressure.
 - f. Oil level.
1. Features and Functions:
 - a. Self-diagnostics.
 - b. Time delay.
 - c. Auto-restart.
 - d. Fuse protection.
 - e. Auto operation mode.
 - f. Manual operation mode.
 - g. Night setback control.
 - h. Power consumption display.
 - i. Run test switch.
 - j. Equalize run time between multiple similar components.
2. Communication: Network communication with indoor units and other outdoor unit(s).
3. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
4. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal suitable for unprotected outdoor locations.
 2. Field Connection: Single point connection to power entire unit and integral controls.
 3. Disconnecting Means: Factory-mounted circuit breaker or switch.
 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 6. Raceways: Enclose line voltage wiring in metal raceways.
- I. Unit Hardware: Zinc-plated steel, or stainless steel. Coat exposed surfaces with additional corrosion-resistant coating if required to prevent corrosion when exposed to salt spray test for 1000 hours according to ASTM B 117.

J. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.7 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor and outdoor units shall include integral controls and connect through a manufacturer-selected control network.
2. Network Communication Protocol: Manufacturer's proprietary or open control communication between interconnected units. (Open protocol is strongly preferred.)
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:
 - a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
 - b. Integration devices shall be connected to local uninterruptible power supply units to provide at least 5 minutes of battery backup operation after a power loss.
 - c. Integration shall include control, monitoring, scheduling, and change of value notifications.
4. Operator Interface:
 - a. Operators shall interface with system and unit controls through the following:
 - 1) Operator interfaces integral to controllers.
 - 2) Owner-furnished PC connected to central controllers.
 - 3) Web interface through web browser software.
 - 4) Integration with Building Automation System.
 - b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:
 - 1) On/off control.
 - 2) Temperature set-point adjustment.

B. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Temperature Units: Fahrenheit.
4. On/Off: Turns indoor unit on or off.
5. Hold: Hold operation settings until hold is released.
6. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
7. Temperature Display: 1-degree increments.
8. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between 45 and 90 degrees F.
9. Relative Humidity Display: 1 percent increments.
10. Relative Humidity Set-Point: Adjustable in 1 percent increments between 5 and 85 percent.
11. Fan Speed Setting: Select between available options furnished with the unit.
12. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
13. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
14. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
15. Occupancy detection.
16. Service Notification Display: "Filter".
17. Service Run Tests: Limit use by service personnel to troubleshoot operation.
18. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
19. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
20. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
21. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

C. Wireless Controllers for Indoor Units:

1. Wireless Communication:

- a. Controller communicates to remote-mounted receiver that is wired to indoor units.
 - 1) Include receivers with wireless controllers as required to complete installation.
 - 2) Low-voltage power required for receivers shall be powered through non-polar connections to indoor unit.
 - b. One wireless controller capable of communicating with one or multiple receivers to control one or multiple indoor units as a group.
2. Controller Battery Life: Minimum three years.
 3. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
 4. Temperature Units: Fahrenheit.
 5. On/Off: Turns indoor unit on or off.
 6. Hold: Hold operation settings until hold is released.
 7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
 8. Temperature Display: 1-degree increments.
 9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between 45 and 90 degrees F.
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 17. Service Notification Display: "Filter".
 18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
 19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
 20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
 21. Setting stored in non-volatile memory to ensure that settings are not lost if power is lost. Battery for date and time only.

2.8 SYSTEM REFRIGERANT AND OIL

- A. Refrigerant: As required by ductless split system manufacturer for system to comply with performance requirements indicated. ASHRAE 34, Class A1 refrigerant classification. R-410a unless indicated otherwise.
- B. Oil: As required by ductless split system manufacturer and to comply with performance requirements indicated.

2.9 SYSTEM REFRIGERANT PIPING

- A. Comply with requirements in other Division 23 Sections.
- B. Divided-Flow Specialty Fittings: Where required by ductless split system manufacturer for proper system operation, ductless split system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.
- C. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

- A. Service Access:
 - 1. Maintain manufacturer's recommended clearances for service and maintenance.
 - 2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations.
 - 3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
 - 4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
- B. Equipment Restraint Installation: Install equipment with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 23.

3.3 INSTALLATION OF INDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.

- B. Unless otherwise required by ductless split system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
- C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
- D. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
- E. In rooms without ceilings, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.
- F. Provide lateral bracing if needed to limit movement of suspended units.
- G. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.
- H. Install floor-mounted units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Division 03.
- I. Attachment: Install hardware for proper attachment to supported equipment.
- J. Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Install outdoor units on support structures indicated on Drawings.
- C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Division 03.
 - 1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 2. Grouting: Place grout under equipment supports and make bearing surface smooth.
- D. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Division 07. Anchor units to supports with removable, stainless-steel fasteners.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved.
- B. Where installing piping and tubing adjacent to equipment, allow space for service and maintenance.

- C. Install piping and tubing in concealed locations unless otherwise indicated except in equipment rooms and service areas.
- D. Conform to Division 23 piping specifications.

3.6 ELECTRICAL INSTALLATION

- A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.
- B. Comply with Division 26 for wiring, grounding, and bonding connections.

3.7 INSTALLATION OF SYSTEM CONTROL CABLE

- A. Conform to Division 23 and 28 requirements.

3.8 IDENTIFICATION

- A. Identify system equipment. Comply with requirements for identification specified in Division 23.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage ductless split system manufacturer's service representative to perform manufacturer's recommended testing and to observe and inspect components, assemblies, and equipment installations, including controls and connections.
- B. Products will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 STARTUP SERVICE

- A. Engage a manufacturer's service representative to perform systems startup service.
 - 1. Service representative shall be an employee or a factory-trained and -authorized service representative of the ductless split system manufacturer.
 - 2. Complete startup service of each separate system.
 - 3. Complete system startup service according to manufacturer's written instructions.
- B. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service. Installer shall correct deficiencies found during startup service for reverification.
- C. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference. All available system operating parameters shall be included in the information submitted.

3.11 ADJUSTING

- A. Adjust equipment and components to function in accordance with manufacturer's recommendations.
- B. Lubricate equipment as recommended by manufacturer.
- C. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.
- D. Set field-adjustable switches and circuit-breaker trip ranges according to ductless split system manufacturer's written instructions, and as indicated.
- E. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of system Installer. Include four service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.13 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software. Provide upgrade notice at least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.14 DEMONSTRATION

- A. Engage a manufacturer's employed training instructor or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.
- B. Location: Owner shall provide a suitable on-site location to host classroom training.
- C. Training Materials: Provide training materials in electronic format to each attendee.
 - 1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
 - 2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.
- D. Acceptance: Obtain written acceptance from Owner's representative that training is complete, and requirements indicated have been satisfied.

END OF SECTION 23 81 26

SECTION 23 82 39.19 - ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes electric heaters with propeller fans and electric-resistance heating coils.

1.2 SUBMITTALS

A. Action Submittals:

- 1. Product Data: For each type of product.
 - a. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- 2. Shop Drawings:
 - a. Include plans, elevations, sections, and details.
 - b. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - d. Wiring Diagrams: Power, signal, and control wiring.

B. Closeout Submittals:

- 1. Operation and Maintenance Data: For wall unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
 - 1. Berko; Marley Engineered Products.
 - 2. INDEECO.
 - 3. Sterling
 - 4. Markel Products; TPI Corporation.
 - 5. QMark; Marley Engineered Products.
 - 6. Trane.

2.2 DESCRIPTION

- A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

- A. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated. Comply with requirements in other Division 23 Sections.

2.6 CONTROLS

- A. Controls: Built in tamper-resistant thermostat.
- B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install unit heaters to comply with NFPA 90A.
- B. Install unit heaters level and plumb.
- C. Ground equipment according to Division 26.
- D. Connect wiring according to Division 26.

END OF SECTION 23 82 39.19

SECTION 25 00 00 – INSTRUMENTATION AND CONTROL INDEX

- 25 13 00 Instrumentation and Control
- 25 30 00 Field Mounted Instruments
- 25 30 10 Instrument Panel Construction
- 25 30 20 Process Controllers and Computer System

(NO TEXT FOR THIS PAGE)

SECTION 25 13 00 - INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification covers the technical requirements for the fabrication, installation, engineering, wiring, adjustment, testing, start-up, commissioning, and training for the instrumentation and control (I&C) systems required for the project.
- B. The instrumentation and control systems shall include all work and materials necessary to perform the control functions as illustrated on the electrical drawings as specified in the Division 25 Specifications.
- C. The Systems Integrator subcontractor shall be responsible for work of Division A. Work related to the workstation, iFix SCADA package and SCADA graphics development, XL Reporter, Top View Alarming and installation shall be by System Integrator (SI).
- D. All software program licenses, software programs, and passwords shall be turned over to the Owner at the end of the project and placed in the Owner's name. All programming copies to owner shall be documented.

1.2 SCOPE OF WORK

- A. This project includes the improvement of existing water supply and treatment facility. The Systems Integrator shall be responsible for but not limited to the following for this project:
 - 1. Furnish and Program New Main PLC Control Panel (MSCP).
 - 2. Furnish new Oxidation Ditch Motor Control Panel (OXDCP). This will
 - 3. Furnish new Sludge Transfer Pump Control Panel (TSPCP2).
 - 4. Furnish new Blower Control Panel (BSCP).
 - 5. Furnish new Main Plant Lift Station Control Panel (PDLSCP).
 - 6. Furnish new Secondary Clarifier Control Panel (SCLCP).
 - 7. Furnish new RAS/WAS Pump Control Panel (RWPCP).
 - 8. Furnish new Remote HMI Control Panel at Maintenance Garage (RHMI).
 - 9. Furnishing, Installing, and Configuring all network functionality between remote sites and local equipment.
 - 10. All local PLC programming and HMI graphics development, miscellaneous status monitoring and alarms.
 - 11. SCADA DELL workstation with SCADA software, iFix or approved equal. Included software and configuration/development shall be XL Reporter with associated EPA and other worksheets, and Top View alarm dialing system or equal.
 - 12. Some of the components integral to the above control panels, such as VFDs, are specified in Division 26, but shall be provided by Division 25. The Division 25 Contractor is encouraged to communicate with the General Contractor regarding Scope of Supply and Scope of Services.

In general, Division 25 shall design, pre-fabricate, program, and otherwise furnish complete the control panels and all components of the control panel and related instruments, for installation and wiring by Division 26. During testing and commissioning, all trades shall work together to place the I & C systems into service.

1.3 NEW SCADA WORKSTATION

A. Provide (1) one new Dell Workstation SCADA PC at new Lab/Office building and Maintenance Garage including but not limited to:

1. 9th Gen Intel® Core™ i7 9700K (8-Core/8-Thread, 12MB Cache, Overclocked up to 4.6GHz on all cores)
2. Windows 10 Pro, 64-bit, English
3. NVIDIA® GeForce RTX™ 2060 6GB GDDR6
4. 64GB DDR4 at 2666MHz
5. 1 TB M.2 PCIe NVMe SSD (Boot) + 2TB 7200RPM 3.5" SATA HDD (Storage)
6. (2) 32" Monitors (Dell - 32-inch LED Curved QHD FreeSync Monitor with HDR S3220DGF)
7. Wireless mouse
8. Wireless keyboard
9. DELL 3 year warranty
10. APC Smart-UPS SRT 1500VA (UPS has to be dual conversion type)
11. Latest Microsoft Office tools (Word, Excel, PowerPoint)

B. SCADA Software

1. Latest version of iFix unlimited runtime license for new workstation, includes 100 point Historian
2. Top View or equal Autodialer Software or equal
3. Antivirus and security software
4. New XL Reporter software
5. Firewall

1.4 QUALITY ASSURANCE

A. All work and materials specified herein shall be furnished by a single Systems Integrator (SI). The SI shall be an experienced and reputable firm, which has been engaged in the business of providing instrumentation and control systems for water and wastewater treatment facilities for at least five years.

B. Drawings and specifications shown are intended to convey information required for a complete functioning system for the purposes specified. The Systems Integrator shall be responsible for all details which may be necessary to properly install, adjust, and place in operation a complete and working system, including all mechanical and electrical installations, final wiring diagrams, connections, and the final layout, sizes and quantities of conduit and wiring communicated to the Electrical Contractor and other trades.

- C. In order to achieve standardization in appearance, operation, maintenance, and spare parts, similar equipment provided under this contract shall be the end products of a single manufacturer.
- D. Codes, specifications, and standards referred to by number of titles shall form a part of this specification to the extent required by the references thereto.

1.5 PRE-CONSTRUCTION SUBMITTALS

- A. Submittals shall be as specified in the General Conditions and as further described below:
- B. Submit the following:
 - 1. Project schedule, which shall represent the Contractor's and System Integrator's best projections of when activities listed below will occur. Project schedules shall be updated at the Engineer's request, when major changes in the schedule occur. The activities shall include, but not be limited to, the following:
 - a. Coordination and loop review meetings
 - b. Shop drawing submittals for each group of equipment
 - c. Shop drawing approvals for each group of equipment
 - d. Equipment manufacturing/panel fabrication
 - e. Equipment delivery
 - f. Equipment installation
 - g. System testing and calibration
 - h. Operational testing and demonstration.
 - i. As-built submittals
 - j. Operation and Maintenance Manual submittals
 - k. Operator training
 - l. Follow-up Operator training at six months after substantial completion.
 - 2. Manufacturer's certification of compliance with the referenced specifications and standards.
 - 3. Certified copies of reports of factory tests specified herein and required by the referenced standards.
 - 4. Shop drawings, indicating performance and physical data of the equipment specified herein.
 - 5. Manufacturer's installation instructions.
 - 6. Provide mounting details for field mounted equipment.
 - 7. Manufacturer's operation and maintenance instructions.
 - 8. If available, USB driver, DVD and CD ROM media produced by the equipment manufacturer, which contain demonstrations of operation and maintenance procedures for the equipment specified herein.
- C. Physical requirements of submittals shall be as follows:
 - 1. Submittals shall be submitted as media on clear (not scanned) pdf documentation.
 - 2. Submittals shall be organized and divided into logical division by means of tagged tabs. Each type of equipment shall be given a separate tab division.
 - 3. Provide an index sheet for the submittals.

4. Drawings shall be on media converted to pdf and printable as 11 by 17 landscape format.
 5. All text material shall at minimum be typewritten. Handwritten material is not acceptable.
 6. Telecopied (FAX) documents or photocopies of faxed documents shall not be included in submittals. Submittals containing telecopied documents will be rejected and returned immediately.
 7. All submitted equipment shall have highlighted features and clear part number designated.
- D. Shop drawings shall include, but not be limited to, the following:
1. Instrument index, which shall include instrument tag numbers, instrument description and instrument calibrated ranges.
 2. Typewritten specification sheets or pdf version, which shall include manufacturer's names and complete catalog numbers.
 3. Detailed calculations as applicable, which shall include, but not be limited to, the following:
 - a. Power supply sizing calculations
 - b. Thermal loading (heat dissipation) calculations
 4. Cut sheets and catalog information, which shall contain equipment specifications, dimensions, wiring and piping drawings, and installation and mounting details.
 5. Loop drawings, which shall contain, but not be limited to, the following information:
 - a. Loop numbers and instrument tag numbers
 - b. Individual loop component locations
 - c. Actual equipment wiring terminal designations, point to point wiring, and cable shield terminations
 - d. Wire type, size and identification number
 - e. Signal types (e.g., 120 Volt AC, 4-20 mA DC, pulse frequency, 3-15 psig, etc.)
 - f. Contact orientations (e.g., normally open, normally closed, etc.)
 - g. Equipment grounding requirements
 - h. Sources of loop power, or power supply identifications
 - i. Signal boosters, interposing relays and shunt resistors
 - 1) Reserve output capacity
 6. Instrument and control panel layout drawings, which shall include, but not be limited to, the following:
 - a. Bill of materials
 - b. Front panel layout drawings
 - c. Swing-out panel layout drawings
 - d. Internal panel layout drawings
 - e. Internal wiring diagrams, including wire type, size and identification number
 - f. Terminal block layout drawings
 - g. Nameplate lists
 - h. Color schedules and samples

7. Elementary control diagrams.
8. Other descriptive information that will assist the Engineer with approval.

1.6 RECORD DRAWINGS (AS-BUILT) SUBMITTALS

- A. Record drawings (as-built) submittals shall be as specified in the General Conditions, further described below:
- B. The record drawings submittals shall consist of, but not be limited to, the following:
 1. Submit one set to the Engineer and one set to the owner of corrected contract documents on a USB drive formatted and organized in pdf files. The original contract documents shall be marked to reflect 'as-built' conditions. Corrections shall be made in red.
 2. Submit one set to the Engineer and one set to the owner of corrected loop description. The original loop description shall be marked to reflect 'as-built' conditions. Corrections shall be made in red.
 3. Submit one set to the Engineer and one set to the Owner printer outputs of the final configuration or programs of all programmable controller-based equipment.
 4. Where applicable, submit to the Owner standard magnetic storage devices, such as CD/DVD disks, of all programmable controller-based equipment software and programs.
 5. Submit original licensed copies and original documentation for all software. All software licenses shall be in Owner's name.
 6. Where applicable, submit to the Owner two sets of pre-configured Read-only Memory Modules, such as EEPROMS or UVPROMS, of all programmable microprocessor-based equipment. Each memory module shall be submitted in an anti-static zippered polybag, which shall be clearly labeled and identified.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. The Systems Integrator shall prepare and furnish Operation and Maintenance Manuals of the system, which shall be submitted to the Engineer prior to operator training described below. Provide four (2) bound hard copy sets and one (2) USB drives with complete electronic copy in pdf format.
- B. The Operation and Maintenance Manuals shall include, but not be limited to, the following:
 1. Approved shop drawings amended by approved change orders and as-built conditions.
 2. Manufacturer supplied operating and installation manuals.
 3. Detailed procedures and instructions on the operation, removal, installation, adjustment, calibration, and maintenance of each component provided under this contract.
 4. As-built control panel and enclosure drawings, including termination drawings, PLC input/output (I/O) wiring diagrams, and panel bill of materials.
 5. List of recommended spare parts, which shall include complete catalog numbers
 6. List of local or the nearest manufacturer approved repair and service centers.

1.8 OPERATOR TRAINING

- A. The System Integrator shall provide operation and maintenance training of the Owner's personnel. This training shall include, but not be limited to, the following:
 - 1. The review of the Operation and Maintenance Manuals prepared and furnished by the System Integrator.
 - 2. The review of 'as-built' panel layout drawings and wiring diagrams.
 - 3. Hands-on training in the operation of each instrument and each loop.
 - 4. Hands-on training in the maintenance, removal, and reinstallation of each instrument and each loop.
 - 5. Hands-on training in the programming or configuration of all programmable microprocessor-based instruments. This does not include the PLC system.
- B. For bidding purposes, the System Integrator shall include a minimum training period of one day, at eight hours per day, for up to five persons.
- C. The System Integrator shall bear all expenses associated with the operator training activities, including labor, transportation and material costs.

PART 2 PROCESS DESCRIPTION

2.1 GENERAL

- A. Where indicated, each pump or actuator will have the following pilot and control devices:
 - 1. HAND-OFF-AUTO selector switch.
 - a. In HAND the equipment shall run.
 - b. In OFF the equipment shall remain off.
 - c. In AUTO, the equipment shall be controlled by the PLC
 - 2. Green LED RUN/OPEN light.
 - 3. Amber ALARM light.
 - 4. Elapsed time meter (ETM) only for motors.
- B. The new main PLC control panel, RTU panels, HMI, and SCADA Workstation shall communicate via Ethernet/IP networking protocol. The HMI shall display all parts of the system functionality and alarming. Text only information is not acceptable. Graphically represent all functions of the system with an easy-to-use menu system. Graphics that do not represent proper operation, process functionality, ease of use and operator interface shall be rejected.
- C. All provided variable frequency drives (VFD) shall have Ethernet/IP connectivity to the PLC for monitoring only. Hard wired control and monitoring shall be as shown on drawings. Each VFD shall have a soft programmed Auto/Manual in the PLC that can be selected by the operator. When in

Auto, the VFD shall follow commands from the PLC as described below. In Manual, the operator shall have the ability to manually start/stop each motor and provide a speed setpoint (100% as default) from the HMI and SCADA system.

1. VFD information to be monitored at a minimum via the Ethernet connection (this information shall be available as a pop up when a VFD or motor symbol on the display is pressed):
 - a. VFD and Motor info
 - b. Run status
 - c. Fault status (included parameter and a lookup table so operator can easily identify drive fault problem)
 - d. Motor torque
 - e. Frequency and percentage (drive speed)
 - f. Voltage (each leg)
 - g. Current (each leg)
 - h. Overload status

- D. All provided electric actuators shall have hardwired control and monitoring as shown on drawings. Each actuator shall have a soft programmed Auto/Manual in the PLC that can be selected by the operator. When in Auto, the actuator shall follow the commands of the PLC as described herein. When in Manual, the operator shall be able to force valve opened or closed and if it is a positional type of actuator, set the position from closed to 100% open.

- E. The new main PLC control panel HMI shall have trending for all flows, levels, temperatures and pressures of the system.

- F. The HMI shall have an alarm summary screen.

- G. The HMI shall have pop-up screens for all pump, actuators and other equipment controls.

- H. All plant HMI graphics shall be duplicated on the RHMI panel to be located at the Maintenance Garage. Interconnect the Main Plant PLC with the RHMI via utilization of the Sierra Wireless RV50X cell modem.

- I. Flow rates shall have the following and be represented on HMI and SCADA graphics:
 1. Current Flow Rate in GPM
 2. Total Accumulated Flow in MGD
 3. Current Hour Total in Gallons
 4. Previous Hour Total in Gallons
 5. Current Day Total in MGD
 6. Previous Day Total in MGD
 7. Current Week Total in MGD
 8. Previous Week Total in MGD
 9. Current Month Total in MGD
 10. Previous Month Total in MGD
 11. Current Year Total in MGD
 12. Previous Year Total in MGD

2.2 PROCESS CONTROL AND MONITORING DESCRIPTIONS

A. New Main PLC Control Panel

1. The new MSCP PLC shall be the central control and monitoring of the entire facility. Network connections and communications shall be required to all remote PLCs, VFDs and other Ethernet enabled devices as indicated on the contract drawings.
2. As an informational note, the Division B (lift stations) shall not be included in the scope of this work. The lift station control panels and telemetry are being procured by another vendor and will Utilize High Tide cloud for monitoring and alarms. Also, as part of this project (Division A), a new SCADA package and workstation shall be provided. System Integrator shall be responsible for full coordination and configuration to allow for SCADA software database development. All programming shall have documented tags.

B. Plant Drain Lift Station

1. The plant drain lift station (LS) shall have a control panel as shown on drawings. The LS shall have two modes of operation, PLC control or Float control. These two controls shall be independent of each other. Primary control shall be by radar level transmitter and secondary control shall be by floats. The floats shall enter the pump control panel into an intrinsically safety barrier (ISB) to control relays. These relays shall allow isolated signals to the pump control panel operation and for indication to the MSCP PLC digital inputs.
2. Provide a 2-Position selector switch for PLC/Float Mode selection.
 - a. Float Mode: pumps shall operate independently from the PLC and activate by float control as High Level – both pumps run; Low Level – all pumps off; Lead Level – lead pump run call (either pump 1 or pump 2); Lag Level – second pump starts. Provide a pump alternator to alternate between pump 1 and pump 2 each Lead Level cycle. High level will generate an alarm and energize a local alarm beacon.
 - b. PLC Mode: Auto/Manual mode as described above. Pumps shall operate based on a primary level transmitter while in Auto mode. Via the HMI or SCADA system, setpoint levels can be entered by the operator for High Level, Low Level (pumps off), Lead level and Lag level. When lead level is reached, the lead pump (alternated between pumps 1 and 2 each cycle) shall be called to run, VFD speed setpoint shall be set to 80% as default; provide the start speed as an enterable value. The pump speed shall increase to 100% between the lead and lag call setpoints. Once the lag setpoint is reached, call on the second pump starting at 80% speed. As level continues to rise, increase speed of lag pump. Lag pump shall shutoff when both pump speeds reduce to 80%. Lead pump shall shutoff at pump off setpoint.
 - c. While in PLC mode, the PLC shall continuously monitor the level transmitter, if the level transmitter fails, switch auto control to start and stop the pumps based on float digital inputs. Both pumps shall be started at 100% during this mode of operation.
 - d. Wire a relay on the digital output of the PLC so that it remain energized, if the PLC faults, the relay shall de-energize and automatically put the pump control panel in float mode.

The output contact shall be a NC contact in parallel with the float mode 2-position switch.

C. Decant Lift Station:

1. There is an existing duplex pump control panel noted on drawings as existing RAS pumps. The internal label indicates "Scum Pump". This panel shall be relabeled and utilized as the new decant pump control panel sending water to the plant drain lift station.
2. The existing equipment shall be monitored and controlled by the main PLC. The decanting shall be controlled by the plant drain lift station level transmitter. Allow setpoints for operator to enter Lead and Lag start/stop values. The pumps shall alternated lead each cycle.

D. Sludge Transfer:

1. There is an existing sludge transfer pump control panel to operate the pump in the existing sludge holding tank. This is a duplex panel but only operates one pump at this time. Monitor all components and operation of this pump. The pump is locally controlled by float switches.
2. Provide a new sludge transfer pump control panel as shown in drawings. The new panel shall be designed and built as a duplex pump control panel but shall only operate one pump at this time. Provide a high and low float switch. The pump shall be controlled by these floats as start on high float and stop on low float.
3. The new pump control panel shall be connected to the main PLC for monitoring and alarms.

E. Fine Screen/Influent Structure:

1. The influent structure shall have a fine screen control panel with PLC as provided by the screening manufacturer. Coordinate with the manufacturer to secure database addresses to communicate with their PLC and read into the main PLC and SCADA system all pertinent information. Graphics and information shall be displayed on the main PLC HMI and SCADA software package.
2. Entering into the influent structure is two force mains, 6" and 12". Each force main shall have a flow meter installed in the metering structure feeding the influent structure; flow from the plant drain lift station shall also feed into this structure and will have a flow meter. Each flow rate shall be displayed and independently trended.
3. Flow rates shall be displayed as follows:
 - a. 4" Force Main flow rate (magmeter)
 - b. 8" Force Main flow rate (magmeter)
 - c. Plant Drain flow rate (magmeter)
 - d. EBB flow rate (ultrasonic)
 - e. Total Force Main flow rate (4" + 8")
 - f. Total Influent Structure flow rate (4" + 8" + Plant Drain)
 - g. Oxidation Ditch flow rate (Total Influent Structure flow rate – EBB flow rate)
4. A weir is located near the gate which overflows to the Emergency Bypass Basin (EBB). This overflow shall be measured as flow rate to the EBB. The total influent flow minus the EBB flow rate will be the flow rate to the oxidation ditch.

F. Oxidation Ditch/Aeration Rotors:

1. The oxidation ditch shall have 4 rotors with VFD drives. A local PLC rotor drive control panel shall be provided by the manufacturer to control, monitor and operate the oxidation ditch rotors. Manufacturer will also provide DO and ORP sensors connected to an SC200 controller. Coordinate with the manufacturer for PLC addresses to incorporate monitoring and controls into the main PLC HMI and SCADA system.
2. There will also be included two actuated plug valves. These will be controlled by the oxidation ditch PLC. The main PLC shall monitor all information for display and shall also send to the oxidation ditch PLC the oxidation ditch calculated flow rate as described above.
3. Contractor shall provide a VFD control panel located next to the manufacturer supplied PLC control panel at the oxidation ditch. VFDs shall be controlled by the oxidation PLC via hardwire and monitored via Ethernet connection to main plant PLC. See drawings for details.

G. Secondary Clarifiers:

1. The secondary clarifiers shall require a new drive control panel with VFD units as shown on contract drawings. Each clarifier drive unit shall have typical VFD monitoring and control and shall include an over-torque warning indication and an over-torque shutdown switch. If the shutdown switch is active, drive shall not be able to run until alarm is cleared.
2. The clarifier drive motors shall be manual control only and allow the operator to start/stop units via the HMI or SCADA software.

H. RAS/WAS System:

1. The RAS/WAS system has three pumps, two duty and one as standby. Each motor shall be alternated so they all share as standby. Each motor shall have a VFD and be controlled and monitored by the main PLC.
2. The RAS line and the WAS line shall each have a magnetic flow meter. Allow the operator to set a pumping rate value.

I. UV System/Effluent:

1. A new UV system will be provided and installed. The UV manufacturer shall supply a system control panel with a PLC. Coordinate with the UV manufacturer for data addressing database and integration into the SCADA system.
2. All UV information shall be displayed on the new MSCP HMI and the new SCADA system. Provide appropriate alarms and warnings.

2.3 GRAPHIC DESCRIPTIONS

A. General graphics descriptions for Main PLC Panelview and for SCADA Software Package

1. Provide all necessary graphic screens for a complete SCADA system for new project scope. Screens shall be developed as required to achieve control systems as described in Division 25 and as shown on contract drawings. Develop new screens to cover all new functionalities

- at the WWTP facility. This includes graphics for systems as provided by other manufacturers such as the Screening System, UV System and other.
2. Both of the new SCADA computers SCADA software and the Paneview HMI shall have all the same graphic details and data incorporated.
 3. Graphic screens shall comply with standards presented below or similar as approved by the Engineer. These shall include but not limited to:
 - a. Standard color convention
 - b. Standard security levels and schemes
 - c. Standard screen navigation and pop-up windows
 - d. Standard display screen design
 4. The SCADA software package shall have configured a Data Historian as necessary to provide required process historical records. This shall include all analytical type data such as: flow rates, levels, pressures, dissolved oxygen, ORP, motor runtimes, etc...
 5. Graphics Standard Color Convention
 - a. Equipment Status Colors
 - i. Power ON: Green
 - ii. Motor ON: Green
 - iii. Motor OFF: Yellow
 - iv. Motor FAIL: Red (flashing)
 - v. Valve OPEN: Green
 - vi. Valve CLOSED: Red
 - vii. Valve in travel: Both Red and Green, or Yellow
 - viii. Pending Alarm Warning: Amber
 - ix. Alarm: Flashing Red
 - b. Process Piping Indications
 - i. Raw Water from wells: Dull/Dark Green
 - ii. Backwash water from filters: Brown
 - iii. Raw Sludge: Brown
 - iv. Plant Effluent Water: Light Brown
 - v. Scum Water: Gray
 - vi. Sewage: Gray
 - vii. Clean/Non Potable Water: Cyan (Light Blue)
 - viii. Equipment: Machinery Gray
 6. Screen Navigation and Pop-Up Windows
 - a. Navigation Menu: Provide common, combo-box style drop down navigational menu, on each SCADA screen. Menu shall include the following items and sub-items:
 - i. Overview
 - ii. Plant Overview
 - iii. Process Overview

- iv. Control System Overview
 - v. Flow Summary (Daily, weekly and monthly totals and accumulated total).
- b. Controls - Provide menu and submenu items, which correspond to processes and unit processes unique to associated facility.
 - c. Trends - Provide menu and submenu items to access preconfigured trend pages unique to associated facility.
 - d. Alarm and Setpoints - Provide button to open alarm summary screens. Provide menu and submenu items to permit control setpoint changes as necessary unique to associated facility.
 - e. Reports – Provide quick links to report pages.
 - f. Utilities (applies to SCADA computers only):
 - ii. Launch Microsoft Excel
 - iii. Launch Microsoft Word
 - iv. Launch Data Historian
 - v. Launch Dream Reports
 - vi. Print Screen Button
 - vii. High Tide Cloud
 - viii. 5 other links as requested by owner
7. Animation: In general, minimize unnecessary animation. Standard animation includes the following:
- a. Animate variable signal bar graphs and tank levels.
 - b. Animate wet well water levels.
 - c. Unacknowledged alarm shall flash.
 - d. Change piping colors from light gray on no-flow condition, to process colors as described herein, on positive flow condition.
 - e. Change equipment status indication color as necessary and as described herein.
 - f. All animated level or flow indication will also include a digital dynamic value of that variable.
 - g. Flow direction by arrow movement (incremental flash)
8. Motor Control Pop-Up Window.
- a. Provide a motor control pop-up window for each motor controlled piece of equipment. Double-clicking equipment symbol shall open associated motor control pop-up window.
 - b. Pop-up for VFDs: Pop-up shall have Start/Stop Pushbutton, Manual/Auto Operation Pushbutton, Speed Control Variable Setpoint, Speed Reference Feedback, VFD Fault Indication and Total Runtime Hours. On/Off Status indication will be shown here as well as on the overview screen. Include all data as provided via the Ethernet connection.
 - c. Pop-up for Standard ACL Starters: Pop-up shall have Start/Stop Pushbutton, Manual/Auto Operation Pushbutton, Fault Indication and Total Runtime Hours. On/Off Status indication will be shown here as well as on the overview screen.
 - d. Valve Control Pop-Up Window. Provide valve control pop-up window for every actuated process valve. Double-clicking valve symbol shall open associated control pop-up window. Pop-up shall have Open/Close function when in manual and a Manual/Auto Pushbutton. Open and Closed statuses will be shown on the pop-up as well as the overview screen.

9. Bitmap Images: In general, minimize unnecessary bitmap images (*.bmp, *.gif, *.jpg, etc.). Bitmap images may be used only if they are helpful and useful to the users.
10. Provide new screens for monitoring Generator and ATS switch position status. The following minimum Generator status signals shall be monitored on the SCADA system via Ethernet:
 - a. Run Status
 - b. Prewarning for low oil pressure
 - c. Prewarning for high coolant temperature
 - d. Low oil pressure shutdown
 - e. High coolant temperature shutdown
 - f. Over crank shutdown
 - g. Overspeed shutdown
 - h. Switch off/not in automatic start mode
 - i. Low coolant temperature
 - j. High battery voltage
 - k. Low battery voltage
 - l. Normal battery voltage
 - m. Fuel leak detection status
 - n. Unit ON-OFF-AUTO controls
 - o. Low Fuel
- B. Descriptions of these screens are only for bidding purposes. It will be the responsibility of the Systems Integrator (for PLC and HMI and SCADA Software) to provide all necessary screens to cover all operations of this facility and make the usage of a SCADA system as simple and easy to use for all operators of the utility company. All displays, graphical and other, shall be complete, organized, easy to read and completely tested to assure that all signals are linked correctly.
- C. Include in bid 1 day for a meeting with Engineer to review Display Screens and requirements.

PART 3 EXECUTION

3.1 GENERAL

- A. The System Integrator shall provide all materials and work necessary for a complete and functioning I&C system and shall have full coordination responsibility of the electrical, mechanical, and structural work as specified herein and as shown on the drawings. The System Integrator shall ensure that the instrumentation and control systems work is properly interfaced with equipment and other work furnished under other divisions of the contract documents.
- B. The System Integrator shall install, make final connections to, adjust, test, and start-up the complete instrumentation and control system utilizing the technical service and advice of the various equipment and instrument manufacturers.

3.2 COORDINATION MEETINGS

- A. Coordination and control loop review meetings shall be attended by representatives of the Contractor and the Systems Integrator, and the owner may be invited. The meetings shall be held at

the Engineer's office periodically during the course of the project. The purpose of these meetings shall be to document the compatibility of the mechanical and electrical work as described in Article 3.01, paragraph A. above.

- B. For bidding purposes, the Contractor and the Systems Integrator shall include cost for participation in no less than two (2) coordination and control loop review meetings. Each meeting shall require at least one-half working day.

3.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials and equipment shall be delivered to the job site at a maximum of ten days prior to installation and not before.
- B. All instruments containing electronics components shall be stored off the ground in weathertight enclosures. They shall be kept dry at all times. All plug-in equipment which can be removed from panels without the necessity of disconnecting any wire terminations shall be removed from its panel before shipping. They shall be shipped in separate shipping containers.
- C. All equipment covered by this specification shall be shipped in a thoroughly clean condition, free from sand, oil, grit or grease (except when required for lubrication), weld splatter, or other foreign materials. All panel openings shall be capped.

3.4 INSTALLATION

A. General

1. Installation shall be in strict compliance with individual equipment manufacturer's instructions.
2. All gages and indicators shall be mounted in the upright position.
3. Provide sufficient space around the equipment for maintenance and removal.
4. Cover front panels, gages and indicators, during construction for protection from weld and paint splatter.
5. Unless otherwise impractical, support instruments independent of process piping.

B. Installation Hardware

1. All nuts and bolts shall be stainless steel.
2. Support channels shall be stainless steel unistrut channels with stainless steel hardware.
3. Do not mount equipment directly to masonry or concrete walls. Provide unistrut channels on wall.
4. All equipment mounting plates shall be of 0.25-inch thick minimum stainless steel.
5. All contact surfaces between dissimilar metals shall be gasketed to prevent galvanic reaction.

C. Instrument Disconnect and Surge Protection

1. All analog signal wiring shall be provided with surge protection at both the transmitting end and at the receiving end if the device is located exterior to the building in which the connecting PLC is located.

- a. At the instrument - TP48 by Telematic, Liebert FLW series or equal.
- b. At PLC – SD Series by MTL Surge Technologies or equal.

D. Weather Protection

1. Unless noted otherwise or impractical, all externally located instruments shall be installed to face north.
2. All externally located instruments, indicators, totalizers, control panels and control stations shall be mounted on a panel or mounting plate, which shall be provided with an aluminum or stainless steel weathershield to protect the instruments from direct exposure to the sun and weather. This weathershield shall be 3” wider at each end and have a 6” overhang in front of the instrument. All edges shall be smooth and rounded.

3.5 EQUIPMENT IDENTIFICATION AND TAG NUMBERS

- A. All apparatus, control equipment, and instruments, both panel and field mounted, shall be plainly identified, using the following methods:
 1. Pipe-mounted instruments shall be provided with embossed stainless steel tags, which shall be attached to the instruments by means of stainless steel wire or tie wrap.
 2. Wall, plate, or panel mounted instruments shall be provided with engraved laminated plastic tags, which shall be mounted above, or below instruments. The plastic tags shall be mounted at eye level and shall be visible from a minimum distance of 20 feet. Lettering shall be black on white background.
- B. Tag numbers and engraved or embossed text shall be as shown on the drawings, or as approved by the Engineer during shop drawing approval.
- C. Tag numbers shall conform to the current Instrument Society of America (ISA) Standards, unless otherwise noted, which shall consist of a multi-character prefix, followed by a loop number. Tag numbers shall be as indicated on the drawings.

3.6 TESTING AND CALIBRATION

- A. Test all analog loop zeroes and spans by disconnecting wiring at each transmitter and substituting an approved 4-20madc generator. Adjust the indicators and receiving instruments to indicate the correct value, correlated to the simulated current signal.
- B. Test all annunciator points by placing jumpers across normally open contact inputs, or by disconnecting wiring on normally closed contact inputs.
- C. Submit testing and calibration reports for all instruments to the Engineer.

3.7 COMMISSIONING

- A. This activity shall consist of individual loop/instrument tests, overall systems test, and Operator training. Each test shall be witnessed by representatives of the Contractor, Systems Integrator, Owner, and Engineer.
1. Loop Operation Test: The objective is to demonstrate that the instrumentation and control system individual instruments are ready to be placed into permanent operation. Each loop shall be tested and demonstrated.
 2. Control Function Test: The objective of this test is to demonstrate that all local and remote-control panels, control stations, MCC, and Operator interface functions are ready to place into permanent operation. All features of the WTP CP and HMI shall be demonstrated.
 3. The Contractor shall prepare an agenda for the commissioning and submit to Engineer as part of the shop drawing submittal package.
 4. The Contractor shall conduct training as specified.
 5. Substantial completion of the system shall not be approved until satisfactory completion of the above commissioning tasks.

3.8 WARRANTY

- A. The Instrumentation and Control System shall be fully warranted and guaranteed from defect for a one-year time period, beginning at the date of substantial completion.
- B. During the warranty period adjust, recalibrate, repair, replace and otherwise place back into service any instrument and any item(s) that may require service, including software, at no additional cost to the Owner for any reason.
- C. During the warranty service, provide unlimited on-site software and operation support, at no additional cost to the Owner for any reason.
- D. Respond to a call for service within 24 hours.
- E. At approximately six months completion of the warranty period, visit the plant and perform routine diagnostics and tests to determine on-going operation and performance of the I & C system within the project requirements. Make any and all repairs and adjustments necessary at no additional cost to the Owner for any reason. Conduct additional “follow-up training” to assist the Owner in operation of the plant and to address any operational concerns that may have become known after six months of operation.

END OF SECTION 25 13 00

SECTION 25 30 00 - FIELD MOUNTED INSTRUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The work required under this section includes the provision, installation, start-up, testing and calibration of all field mounted instruments required for this project.
- B. This section covers field mounted instruments provided separately from a manufactured system or process equipment package, to be used on the various portions of the project, and the Contractor shall meet the requirements of these Specifications wherever applicable.
- C. The types of field mounted instruments required for this project include the following:
 - 1. Submersible Pressure Transmitter
 - 2. Magnetic Flow Meter
 - 3. Ultrasonic Flow Meter (weir and parshall flume)
 - 4. Float Switches
 - 5. Pressure Switches
 - 6. For VFD units in control panels, see Division 26

1.2 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of field mounted instruments and systems of types and sizes required, whose products have been in satisfactory use in similar service, and whose products meet all requirements specified herein.
- B. Installer: Qualified with successful installation experience on projects with field instrument work similar to that required for this project.
 - 1. It is intended that an experienced electronic systems/instrumentation and control systems subcontractor shall be in responsible charge of all field instrument work.
- C. ISA Compliance: Comply with applicable Standards and Practices for Instrumentation published by the Instrument Society of America pertaining to field mounted instruments and related installations.
- D. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical systems, and provide products and components which have been UL-listed and labeled whenever such UL listed products are available.
- E. NEC Compliance: Comply with requirements as applicable to construction and installation of field mounted instruments and installations.

1.3 SUBMITTALS

FIELD MOUNTED
INSTRUMENTS

25 30 00 - 1

- A. Prepare and submit shop drawings and descriptive data for each instrument and information regarding field installation of each instrument.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship instruments and accessories properly protected and packaged.
- B. Handle instruments and accessories carefully to prevent damage and protect from weather.

PART 2 - PRODUCT

2.1 GENERAL

- A. For each field mounted instrument, provide a complete assembly with all required components, enclosures suitable for the environment and location, fittings, mounting brackets, and other components and accessories as needed to form a complete system.
- B. Provide conduit, raceway accessories, wiring and connections necessary to place the instruments into service and necessary to interface the instruments to other equipment control panels, programmable controllers, SCADA system, and similar installations as required for the project.
- C. Include TVSS units as specified per specification 25 30 00 where required.

2.2 SUBMERSIBLE PRESSURE TRANSDUCER

- A. General
 - 1. Provide total two loop powered (2) submersible pressure transmitters for this project.
 - a. Plant Drain Lift Station – in stilling tube
 - b. Sludge Wet Well – in stilling tube
 - 2. This section describes the requirements for a submersible level measuring system. Under this item, the contractor shall furnish and install the level measuring system, and all associated equipment and accessories as indicated on the plans and as herein specified.
- B. Primary level control shall be from a submersible pressure transducer.
- C. The liquid level of the following areas shall be sensed by maintenance free Loop Powered Submersible Level Transducer system that uses reliable hydrostatic head pressure sensing principle to provide an accurate and reliable proportional 4-20 mA signal representing level/pressure. Other technologies that can be affected by foaming, turbulence, grease, suspended solids build up, atmospheric changes, condensation, or false echoing shall not be acceptable. Submersible sensor systems that use protective caps or cages to protect the sensing diaphragm, are susceptible to solids build up, shall be considered high maintenance and unreliable, and shall not be acceptable.

The transducer shall be suitable for continuous submergence and operation and shall be installed in accordance with manufacturer's instructions. The bottom diaphragm face of the sensor shall be installed 6 inches above the floor. The sensor shall be mounted using a stainless steel cable system.

- D. The transducer housing shall be fabricated of a Teflon™ coated 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon™ bonded to a synthetic rubber back/seal. System design shall allow maintenance free operation in both water and wastewater environments (high solids). Housing construction shall resist and be unaffected by the buildup of solids on its surfaces or sensing diaphragm. The transducer electronics shall be encased within the protective housing and shall be electrically and mechanically isolated from the sensed media via non-conductive fluid filled pressure transference cavity and barometric compensated transducer electronics chamber. Metallic or ridged diaphragms shall not be acceptable in that they are subject to damage or distortion.
- E. The submersible level transducer shall be a two-wire type and shall operate from a supply voltage of 9 to 30 VDC and produce a 4-20 mA signal in direct proportion to the measured level excursion over a pre-calibrated range of 0 to 30 PSI. The unit shall have ample instrument loop load capacity and shall be able to drive a minimum load of 750 Ohms @ 24 VDC loop power. The sensor technology shall be based on the use of a highly reliable and stable piezo-resistive pressure element with a .25% full scale accuracy with compensation for non-linearity, hysteresis and repeatability. The unit shall operate over a wide –40 to 185 degrees F. temperature range and shall have not more than a 3% full scale error over a –4 to 180 Deg F. range.
- F. The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures (8X (1.5 PSI) 4X (5 PSI) 2X (15 & 30 PSI) –Select One) times the full-scale range being sensed. Sensing principles employing less reliable technologies including LVDTs, capacitance or pneumatic elements shall not be acceptable.
- G. The internal pressure of the transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly with a dedicated breather tube. The tube shall be ridged to prevent compression that may result from mounting or folding of the cable through installation. The breather system shall be sealed through the use of a rugged maintenance free air bladder assembly connected to the breather tube and mounted within a junction box or monitoring panel. The sealed breather system shall compensate for variations in barometric pressure including expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive/atmospheric elements.
- H. The transducer shall be installed where directed by the Engineer and connected with other system elements and placed in successful operation. It shall be provided with input power and output signal transient protection, associated control elements as specified herein and in accordance with manufacturer's instructions.
- I. Acceptable Manufacturers:
 - 1. AGP PT-500 Series
 - 2. A1000i as manufactured by Siemens Water
 - 3. Or Approved Equal.

2.3 MAGNETIC FLOW METERS

- A. Provide (1) magnetic 16" flow meter.
- B. Acceptable Manufacturer:
 - 1. E&H Promag W400 with remote electronics
 - 2. Krohne Optiflux 4000 and IFC-300 Convertor
 - 3. or approved equal
- C. METER:
 - 1. Shall be a velocity sensing electromagnetic type flanged tube meter with sealed housing for 150 PSI working pressure. The meters shall be a 16-inch for West side of Cline Ave. plant manhole.
 - 2. Meters shall have a digital indicator having a range as shown below, shall be equipped with a 9 digit digital totalizer reading in units of US gallons, and shall be accurate within 0.5% of actual flow.
 - 3. The indicator display shall be direct reading. The system shall be designed for an ambient temperature range of -40 F to 125o F and a 120 VAC 60 Hertz power supply. The system power consumption shall be approximately 5 watts per inch diameter. The meter assembly shall operate within a range of 0.2 FPS to 32 FPS and be constructed as described herein.
 - 4. The sensors have a rugged, robust construction to ensure a long, maintenance-free life under the arduous conditions experienced in the wastewater industry. The sensors shall be inherently submersible (IP68, NEMA 6P), thus ensuring suitability for installation in chambers and metering pits that are susceptible to flooding. The meters shall be designed for the measuring the material (MLSS and sludge) for which they are being specified.
- D. METER TUBE (SENSOR):
 - 1. Shall be fabricated stainless steel pipe and use 150 lb. AWWA Class "D" flat face steel flanges (UM06) or 300 lb. AWWA Class "F" raised face steel flanges (UM08). The internal and external of the meter tube shall be blasted and lined with a NSF approved fusion bonded epoxy UltraLiner™, applied by the fluidized bed method.
 - 2. Meter tubes shall have a constant nominal inside diameter offering no obstruction to the flow. Electrodes shall be 316 stainless steel.
- E. MAG SHIELD:
 - 1. Shall be welded to the tube providing a completely sealed environment for all coils, electrode connections and wiring harness capable of NEMA 6P/IP68 operation.
- F. SIGNAL CONVERTER:
 - 1. Shall be pulsed DC coil excitation type with auto zeroing. The converter shall indicate direction of flow and provide a flow rate indication and a totalization of flow volume for both forward and reverse directions. Both forward and reverse totalizers shall be electronically resettable.
 - 2. The flow meter converter shall be microprocessor based with a keypad for instrument set up and LCD displays for totalized flow, flow rate engineering units and velocity.

3. The converter shall power the flow sensing element and provide galvanically isolated dual 4-20mA outputs. 4-20 mA outputs shall be capable of system integration with a central terminal unit or a PLC. It shall be possible, in the test mode, to easily set the converter outputs to any desired value within the range. The 4-20mA scaling, time constants, pipe size, flow proportional output, engineering units and test mode values shall be easily set via the keypad and display.
4. Four separate fully programmable alarm outputs shall be provided to indicate empty pipe, forward/reverse polarity (normally open/close), analog over-range, fault conditions, high/low flow rates, percent of range and pulse cutoff.
5. The converter shall periodically perform self-diagnostics and display and resulting error messages. All set up and data and totalizer values may be protected by a password.
6. The converter shall be remotely mounted up to 500 feet from the sensor, and shall be supplied in a sealed IP67 rated enclosure. Calibration will be completed at the manufacturer's location in accordance with customer supplied application-based requirements.

G. GROUNDING RINGS:

1. Shall be 316 stainless steel and shall be supplied with the meter tube. Exception: On sensor models which use grounding electrodes, grounding rings are optional. For best performance, grounding rings are recommended for all sizes.

H. POWER AND SIGNAL ISOLATION:

1. The power supplied between the converter and the meter tube (sensor) and signal between the meter tube and the converter shall be isolated and placed in separate submersible cables.

I. SERVICE & SUPPORT:

1. Supplier must have flow calibration laboratories and personnel to perform testing and certify calibration. Personnel must also provide instruction or training as required assuring meters are supported and maintained throughout the guarantee period.

J. VOLUMETRIC TESTING:

1. All meters must be performed and approved prior to shipment. The complete meter assembly and signal converter must be wet accuracy tested and calibrated. The test facility must be rigorously traceable to an accuracy of $\pm 0.15\%$ with the National Institute of Standards and Technology. If desired, the test shall be witnessed by the customer or their selected agent. A copy of the certified accuracy test record must be furnished at no charge to the Owner.

2.2 ULTRASONIC FLOW METER

- A. Provide ultrasonic flow meters for two (2) locations, the influent structure weir and the effluent Parshall flume.

- B. This specification covers a non-contacting ultrasonic Level/Flow. This instrument shall provide for indicating, transmitting and control of the material level in a vessel or proximity of a target to the instrument sensor, and indicating, transmitting, and totalizing of the flow rate through a flume, weir, or other primary measuring device.
1. Level/Flow Monitor to consist of a non-contacting ultrasonic sensor, connecting cable, and a remote enclosure with indicating, transmitting and controlling electronics.
 2. Measurement accuracy shall be $\pm 0.25\%$ of Range or 2 mm (0.08"), whichever is greater, and shall be automatically temperature compensated.
 3. Sensor cable length shall be as required by installation, not to exceed 500' (152 m).
 4. System shall have no moving parts and shall not contact the material being measured.
 5. Shall include PC software program disk to determine open channel flow calibration values for non-standard flumes and weirs if used for flow rate calculations.
- C. Sensing Element
1. Sensor shall be constructed of PVC and Teflon.
 2. The sensor shall have a minimum deadband or blanking of 12" (305 mm) and a maximum range of 32 ft. (10 m), and have an operating frequency of 42 kHz with an ultrasonic beam angle of 8 Degrees.
 3. Sensor shall withstand accidental submersion to 20 psi.
 4. Sensor operating temperature shall be from -40°F to 150°F (-40°C to 65°C).
 5. Sensor shall include integral temperature sensor. Temperature sensors requiring separate mounting and wire runs shall not be accepted.
- D. Sensor Connecting Cable
1. Provide RG62AU coaxial cable 25' (7.6m) continuous length, with waterproof, potted bond to the Sensor head.
 2. Extended sensor cable shall be RG62AU coaxial to a maximum of 500' (152m). Cable shall be spliced with screw terminal connections in manufacturer's recommended steel NEMA4 Junction Box.
 3. Level and temperature signals shall be conducted on one single coaxial cable. Separate or multiple-conductor cables shall not be accepted.
 4. Sensor cable shall be installed in grounded conduit.
- E. Transmitter
1. The transmitter shall provide for field-calibration via built-in 5-key calibration system with menu selection of parameters. Systems requiring calibration by Parameter codes, BCD switches or external calibrators shall not be accepted.
 2. Calibration data shall be password protected and permanently stored through power interruptions for a minimum of 12 months.
 3. Field calibration shall allow selection and automatic conversion of measurement units, measurement span and control relays.
 4. The transmitter shall provide for field calibration in user-selected Range, Level or Open Channel Flow modes. Flow mode shall allow calibration to common primary metering

devices, plus allow entry of calibration formula for non-standard flumes, weirs or open channels.

5. Transmitter shall permit field programmable damping to smooth output with turbulent level.
6. Transmitter operating temperature shall be from -5° to 140°F (-20° to 60°C). Transmitter shall contain a thermostat-controlled enclosure heater for condensation protection below 30°F (-1°C).
7. Transmitter shall have an isolated 4-20mA output rated for 1000 ohm maximum load with menu-selectable 0-5VDC alternative.
8. Provide two relay contacts rated 5 amp SPDT programmable for single set point alarms, dual set point pump control, pump alternation, temperature alarm, flow totalizer pulse and/or echo loss alarm.
9. Provide a white, backlit matrix LCD display indicating flow rate, level, velocity, totalizer and relay states in user-selected engineering units.
10. Transmitter display indicating level or flow rate, units of calibration, totalizer and relay states shall be visible without opening cover.
11. Transmitter shall be housed in a wall-mount, watertight NEMA4X (IP66) enclosure with hinged, clear cover. Mounting hardware shall be included.
12. Transmitter electronics shall be surge protected on AC power input, sensor and 4-20mA outputs.
13. Transmitter power input shall be 100-240VAC 50-60Hz with power consumption of 3.5 Watts or less.
14. The transmitter shall permit plug-in field installation and auto-detection of optional accessories including data logger and additional control relays.

F. Acceptable Manufacturers:

1. Endress & Hauser FMU90 with FDU91 Level and Flow monitor
2. Or Approved Equal

G. Installation

1. The unit shall be installed according to the manufacturer's recommendations.
2. Mount the sensor to ensure a clear path to the surface being measured.
3. Provide stainless steel or FRP mounting brackets as required.

2.3 FLOAT SWITCHES

A. Float switches to be used for backup level control and/or primary control as indicated on drawings.

B. Operating Principle

1. Direct acting, non-mercury float switch, encased in an ellipse shaped molded plastic float, connected to a factory installed cable. Float cable length to be determined by Contractor.
2. The float shall be either pipe-mounted, or suspended by its cable by means of a weight kit, as indicated in the equipment data.

C. Specifications

1. Construction

- a. Float material: High impact styrene
- b. Mounting: 3/16" SS aircraft cable attached to a 10 pound concrete weight or similar coated boat anchor.
- c. Strap float cables individually with PVC cable ties to aircraft cable. This shall allow removal of one float without affecting the other floats.
- d. See Drawings for float switching elevations.

2. Electrical

- a. The switch contacts shall be normally open or normally closed as indicated in the equipment data.
- b. The switch contacts shall be rated 6 amperes, non-inductive at 120 Volts AC. Switches shall be normally closed unless noted otherwise.
- c. The cable shall be two fine-stranded AWG #18 conductors in heavy-duty type SJO- W Neoprene jacketing. Standard length of the cables shall be 40 feet.

3. Performance

- a. The switch shall make and break over a 1-inch level change.

4. Manufacturer

- a. Dura float
- b. Approved equal

2.4 PRESSURE SWITCHES

A. Pressure Tap Sensing Lines and Pressure Switches

1. For Process Sensing Taps in Ductile Iron, Steel and Stainless Steel Piping Systems:

- a. Material and Fittings: Type 304 stainless steel pipe (ASTM A 312) and threaded fittings and adapters (ASTM A 403).
- b. Sizes: 1/2-inch minimum for main sensing piping and 1/4-inch gage and switch connections.
- c. Accessories:
- d. For applications not requiring diaphragm seals, provide separate 1/4-inch Type 316 stainless steel threaded gauge cocks for each gauge and switch.

- I. For applications requiring diaphragm seals, provide a separate 1/2-inch shutoff ball valve for the process side of the diaphragm seal for each gauge and switch.

2. For Process Sensing Taps in Copper and Thermoplastic Piping Systems:

- a. Pipe Material and Fittings: Use same type of pipe material and fittings as that used in the process piping system.
 - b. Sizes: 1/2-inch minimum for main process sensing piping and 1/4-inch for gage and switch connections.
 - c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in the piping schedules on the contract drawings.
 - d. Accessories:
 - II. For copper piping system taps with or without seals, provide a separate 1/4-inch minimum threaded brass or bronze gage cock for each gage and switch.
 - III. For PVC and CPVC piping systems with or without diaphragm seals, provide a separate 1/2-inch threaded ball valve for process sensing line shutoff for each gage and switch. Ball valves are to be thermoplastic.
3. Each pressure switch shall have an adjustable pressure range and ability to provide a high pressure output and low pressure output dry contact to a PLC or other indicating device.
 4. Manufacturer
 - a. E&H Ceraphant T PTC31
 - b. Or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Each instrument or system shall be installed, wired, calibrated, and tested in strict compliance with the manufacturer's instruction. Calibrate for operational range required for this project.
- B. Installation Hardware
 1. All nuts and bolts shall be stainless steel.
 2. Support channels mount externally, or mounted in a corrosive atmosphere, shall be stainless steel unistrut channels.
 3. Do not mount equipment directly to masonry or concrete walls. Provide unistrut channels on wall.
 4. All equipment mounting plates shall be of 0.25-inch thick minimum stainless steel.
 5. All contact surfaces between dissimilar metals shall be gasketed to prevent galvanic reaction.
- C. All test instruments used for field calibrations shall have a minimum accuracy of 3 times greater than that of the instrument being calibrated. Test instruments shall have been calibrated to National Bureau of Standards requirements within 6 months of their use on this project. Provide evidence of such calibration upon request by the Owner of Engineer.
- D. Final conduit connection to the instruments shall be through watertight flexible conduit. Where noted, final connection shall be by extra hard service cable rated for wet location. Use explosion-proof or liquid-tight flexible conduit where required.

- E. Line powered units shall receive 120-volt AC supply through a disconnect switch and surge protector, see specification 13600 for description.

3.2 ENVIRONMENTAL PROTECTION

- A. Transmitters and similar items located outdoors or in unheated or untreated spaces must be manufactured for the environment to be encountered. If not suitable for the environment where located, the Contractor shall provide a heated and insulated and exhaust fan ventilated enclosure suitable for the environment, to protect the transmitter or instrument.
- B. All transmitters and local control stations shall have aluminum sheet metal sun shields/weather shields.

3.3 CALIBRATION

- A. In addition to the above requirements, calibrate each system as follows:
 - 1. Each system, including its complete instrument loop, shall be calibrated. Reading on the remote receiving instruments shall be equal to reading at the converter indicator.
 - 2. Provide a written loop-calibration report for each system, which shall include but shall not be limited to the following:
 - a. Date & time the final calibration was completed.
 - b. Atmospheric conditions when the final calibration was performed.
 - c. Comparison of readings at the converter with readings at the remote receiving instruments.
 - d. Provide a table showing calculated and measured values at 0%, 25%, 50%, 75% & 100%.
 - e. Verification of accuracy of the outputs, including those at the receiving instruments.
 - f. Verification of operation of all contact outputs, including those at the receiving instruments.
 - g. Description of method of calibration.
 - h. The names and signatures of personnel performing the calibration. Provide room for 2 names.
 - i. The names and signatures of engineer's field representatives. Provide room for 2 names.
 - j. Special comments or notes, including "as left" conditions.
 - k. This report may be 2 pages if required for each instrument.

END OF SECTION 25 30 00

SECTION 25 30 10 - INSTRUMENT PANEL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification covers the technical requirements for the fabrication, engineering, wiring and installation for instrument panels and enclosures.
- B. The instrument panels shall be as shown on the drawings. They shall include, but shall not be limited to the following:
 - 1. New Furnish and Program New Main PLC Control Panel with HMI (MSCP)
 - 2. Furnish new Oxidation Ditch Motor Control Panel (OXDCP)
 - 3. Furnish new Sludge Transfer Pump Control Panel (TSPCP2)
 - 4. Furnish new Blower Control Panel (BSCP)
 - 5. Furnish new Main Plant Lift Station Control Panel (PDLSCP)
 - 6. Furnish new Secondary Clarifier Control Panel (SCLCP)
 - 7. Furnish new RAS/WAS Pump Control Panel (RWPCP)
 - 8. Furnish new Remote HMI Control Panel at Maintenance Garage (RHMI)

1.2 SUBMITTALS

- A. Submittals shall be as specified in the appropriate sections.
- B. Each panel submittal shall have a complete layout drawing of all equipment and a parts list.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The instrument panels and enclosures shall be as follows:
 - 1. Located in environmentally controlled (heated and ventilated) rooms, shall be steel rated NEMA 12.
 - 2. General instrumentation and control panels located outdoors or in non-air-conditioned areas shall be stainless steel rated NEMA 4X.
- B. NEMA 12 enclosures shall be painted electro-statically, prior to equipment installation:
- C. The exterior surfaces of a NEMA 4X stainless steel enclosure shall not be painted. The finish shall be sandblasted, roughened or chemically etched to reduce gloss, reflections & glare.
- D. Conduit knockouts on the enclosure shall be made prior to installation of any equipment within the

enclosure. The size and the number of conduit knockouts shall be as required. Provide malleable iron watertight conduit hubs for all NEMA 4X enclosures.

- E. All enclosures exposed to weather conditions shall be provided with sun shields to protect the enclosure from direct exposure from the sun and rain.

2.2 PANEL CONSTRUCTION

A. General

1. Stiffening members shall be provided for strength and stiffness as required.
2. Seamless welded construction shall be used throughout. All exposed seams shall be continuously welded and ground smooth.
3. Lifting rings shall be provided for panels in excess of 100 pounds.
4. Subpanels shall be provided as required, with mounting designed for easy removal. The subpanels shall be finished with 2 coats of white enamel paint.
5. Print pockets shall be attached to the interior side of each door.
6. Hinges shall be stainless steel piano type.

B. NEMA 12 Enclosures

1. NEMA 12 enclosures shall be fabricated from 12 gauge cold rolled sheet steel or better.
2. Double doors shall be of the flush type construction with continuous hinge and gasket.
3. Doors shall be equipped with three-point latching mechanism and door locks.
4. Corrosion inhibitors shall be furnished for corrosion control inside the panel.

C. NEMA 4X Enclosures

1. Nema 4X enclosures shall be fabricated from 14 gauge stainless steel or better.
2. Enclosure door shall be provided with neoprene gasket, which shall be attached to the enclosure with oil-resistant adhesive, and held in place with stainless steel retaining strips.
3. Door clamps shall be provided on three sides of the enclosure door.
4. A hasp and staple shall be provided for padlocking.
5. Panel heaters, corrosion inhibitors and breather drains shall be furnished for condensation and corrosion control inside the panel. Panel heaters shall be of the forced air types, provided with integral thermostat control.

D. PANEL GROUNDING

1. Where noted or specified, provide a ground bus tied to the facility grounding system.
2. The ground busbars shall be of nickel-plated copper, rated for at least 100 amperes.
3. The busbar shall be provided with two (2) screw clamp terminal blocks, which shall be capable of accepting conductors up to #2 AWG.
4. The busbar shall be provided with a minimum of twenty (20) screw clamp terminal blocks, which shall be capable of accepting conductors up to #10 AWG.

2.3 PANEL WIRING

- A. Wiring within the enclosure shall be continuous and shall be terminated only at terminal blocks or equipment terminals.
- B. Not more than two wires shall be terminated at any terminal.
- C. Wiring splices and wire nuts will not be permitted within the enclosure.
- D. Wiring within the enclosure shall be protected as follows:
 - 1. In general, all wiring within the enclosure shall be put in plastic wiring ducts. Wiring ducts shall be sized to include 100% (percent) spare capacity.
 - 2. Wiring outside of the ducts shall be restrained by means of plastic ties.
 - 3. Wiring passing a door hinge shall be grouped and wrapped in a protective wire harness.
 - 4. Provide abrasion protection for any wire bundles passing through holes or across sheet metal edges.
- E. In general, wiring within the enclosure shall be as follows:
 - 1. 120VAC control wiring within and external to the enclosure shall be #14 AWG stranded.
 - 2. DC control wiring within the enclosure shall be #16 AWG stranded.
 - 3. Wiring for long distance DC signals shall be #14 AWG stranded.
 - 4. Wiring for 4-20 mA DC analog signals shall be #16 AWG twisted shielded pair.
- F. In general, wiring within the enclosure shall follow the following color convention to comply with NFPA 79 (1994), part 16.
- G. AC and DC wiring shall be separated from each other. Where AC and DC wire runs parallel, the minimum separation between them shall be four (4) inches. Where AC and DC wire runs cross, they shall cross at 90°. Provide separate wiring duct for AC and DC wiring.
- H. Equipment and signal ground wiring, as well as Neutral wiring, shall not be daisy-chained; they shall each be terminated at isolated, bussed terminal blocks.
- I. Each conductor end shall be terminated at a terminal block or at an equipment wiring terminal. Each terminal block shall have a unique identification number. The terminal blocks shall be arranged and numbered in consecutive order, based on standard alpha-numeric order.
- J. Terminal blocks within each enclosure shall be grouped for the voltage and type of circuit connected.
- K. Provide 25% spare terminal blocks (minimum of six) for each type used in each enclosure.

2.4 TERMINAL BLOCKS

- A. Terminal blocks within enclosures shall be of the high-density modular types, constructed of nylon material, suitable for mounting on standard DIN rails. Termination type shall be tubular screw with serrated pressure plate. The terminal block system shall be manufactured by Phoenix Contact, Weidmuller, or pre-approved equal.
- B. All current carrying parts (metal bodies) shall be made of nickel/tin-plated copper.
- C. Ground terminals shall be color coded in accordance with international standard, which shall be yellow/green.
- D. Matching jumper bridges shall be color coded to the wiring colors.
- E. Panel power distribution fused terminal blocks shall be provided with disconnect lever puller mechanism and illuminated indication.

2.5 PANEL ACCESSORIES

- A. The Systems Integrator/enclosure fabricator shall be responsible for all accessories, including interposing relays, analog signal isolators, terminal blocks, power distribution blocks, grounding blocks, fuse blocks and fuses, circuit breakers, duplex receptacle, heaters, exhaust fans, louvers and filters, DIN mounting rails, plastic wiring channels, hardware, wire tags, engraved nameplates, and all such accessories needed for a professional class panel fabrication.
- B. Panels shall have the appropriate cooling and heating equipment. Panels located indoors with climate control shall require proper cooling and exhaust fan units when VFD units are installed. Panels with VFD units located outside shall have a properly sized air conditioning and heating unit.
- C. Panels located outdoors shall include corrosion inhibitors for environment protection.

2.6 PILOT AND CONTROL DEVICES

- A. Pilot Devices: Pushbuttons, selector switches, and indicating lights shall be rated heavy-duty, oiltight or watertight and corrosion resistant as required. All units shall be furnished with standard size legend plates with legends as indicated on the project Drawings.
- B. For Class 1, Division 2 areas, devices shall either be explosion proof type, or all contacts and other items which may arc or spark shall be hermetically sealed. Hermetically sealed contacts and devices shall meet the current and voltage ratings required for the circuit.
- C. Selector switches shall have the number of positions, switching arrangement, number and type of contact blocks indicated on the project Drawings.

- D. Contact blocks shall have a minimum continuous current rating of 10 amperes at 240 VAC. Contact blocks shall have screw type connection terminals.
- E. Indicating lights shall be LED type only. Provide flashing type lights where indicated.
- F. Pilot lights shall be 120VAC, push-to-test (PTT) 30mm type.
- G. Pilot device manufacturers shall be:
 - 1. Square D, Class 9001, Type K
 - 2. Allen-Bradley Bulletin 800H or 800T
 - 3. IDEC
 - 4. Approved Equal
- H. Control relays shall be plug-in type with sockets and hold-in clips. Sockets shall have screw terminals, compression terminals not acceptable. Contacts shall be silver-cadmium, rated 10 amperes at 240 VAC. Relays shall have as a minimum two pole, double throw contacts (2PDT). Relays shall have a manual operator and miniature pilot light. Coil voltages shall be 120 VAC, or as noted on the project Drawings. Relays shall be as manufactured by Allen-Bradley Bulletin 700, Type HA or HB, Square D, Idec, or approved equal.
- I. PLC digital output isolation relays shall be SPDT type with minimum 6A rated contacts. Coil voltage to match PLC output card. Phoenix Contact or equal.
- J. Latching relays shall be similar to the control relays. Relay position shall be magnetically held, and shall be the single coil type.
- K. Timing relays shall be solid state, plug-in type with screw terminal sockets. Each relay shall have 5 adjustable timing ranges, switch selectable, and 4 timing modes, switch selectable. Timing ranges shall allow from 0.05 seconds to 999 minutes timing. Timing modes shall be ON delay, OFF delay, ONE SHOT, and REPEAT CYCLE. Output contacts shall be DPDT, rated 10 amperes at 240 VAC. Timing setting shall be by thumbwheel switches. Coil voltages shall be 120VAC, or as noted on the project Drawings.
- L. Elapsed Time Totalizers (ETT's) shall be the synchronous motor driven type with digital readout to indicate the total time a piece of equipment is energized. Totalizer shall have a minimum of six-digit wheels including a 1/10-digit wheel to provide the range of time measured in hours, unless noted otherwise. Units shall be non-resettable, and operate on 120V, 1 phase, 60 Hz. Elapsed Time Meter (ETM) shall be considered synonymous with Elapsed Time Totalizer (ETT).

2.7 EQUIPMENT IDENTIFICATION AND WIRE TAGGING

- A. All equipment and wiring identifications shall conform to and be compatible with the Owner's current labeling system, and shall be completed prior to final acceptance of the work. It is the responsibility of the Contractor to coordinate with the Owner's Engineer, to obtain from him or her, all labeling standards and documentation.

- B. All control wiring shall be identified by means of computer-generated, heat shrink type wire marker. Wire numbers shall be as shown on the drawings.
- C. Each major component mounted within the enclosure shall be provided with equipment identification. Equipment and device nameplates or identification shall be of engraved laminated plastic, with black lettering on white background. Nameplates shall be as listed herein or as shown on the project Drawings.
- D. The enclosure vendor shall be responsible for providing and sizing all instrument loop power supplies. The instrument loop power supplies shall be sized to include at least 100% spare capacity. The enclosure vendor shall submit power supply load calculations with the panel shop drawings.

2.8 REGULATED POWER SUPPLY

- A. When DC power supply is required for PLC discrete inputs, and 2-wire analog loops, provide at least two redundant 24 V DC regulated power supplies. A redundancy module with alarm contacts shall be provided for auto-switching of power supplies and power supply failure notification.
- B. The power supply shall be sized to include 100% spare capacity.
- C. Acceptable power supply manufacturers:
 - 1. Phoenix Contact
 - 2. SOLA
 - 3. IDEC
 - 4. Approved equal

2.9 UNINTERRUPTIBLE 120VAC POWER SUPPLY

- A. When panels include a programmable controller or computer, provide an uninterruptible power supply to condition incoming power and ride-through utility power interruptions. UPS shall be 1500VA minimum unless otherwise noted.
- B. This location has generator backup system; therefore, all UPS units shall be of dual conversion type confirmed by manufacturer to work properly with generators.
- C. Acceptable power supply manufacturers:
 - 1. APC SRT series
 - 2. or approved equal

PART 3 - EXECUTION

3.1 GENERAL

- A. All panels shall be installed level and plumb.

B. Installation Hardware

1. All nuts and bolts shall be stainless steel.
2. Support channels mount externally, or mounted in a corrosive atmosphere, shall be either reinforced fiberglass or stainless steel unistrut channels. All cuts and holes on fiberglass unistrut channels shall be coated with appropriate resin coating to protect them from deterioration.
3. Do not mount equipment directly to masonry or concrete walls. Provide unistrut channels on wall.
4. All equipment mounting plates shall be of 0.25-inch thick minimum clear anodized aluminum.
5. All contact surfaces between dissimilar metals shall be gasketed to prevent galvanic reaction.

- C. Touch up all nicks, scratches, etc. with materials as recommended by the enclosure manufacturer.

END OF SECTION 25 30 10

(NO TEXT FOR THIS PAGE)

SECTION 25 30 20 - PROCESS CONTROLLERS AND COMPUTER SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. The work required under this section includes the provision, installation, start-up, testing and calibration of all computer, controller, software and networking required for this project.
- B. The types of systems required for this project include the following:
 - 1. Desktop PCs for Lab, see Division 25 13 00
 - 2. iFix licensed unlimited runtime SCADA package
 - 3. XL Reporter
 - 4. Top View Alarm Software
 - 5. AB CompactLogix 5370 Process Controller
 - 6. Panelview Plus 7 HMI
 - 7. Panelview Graphics Package
- C. The Systems Integrator shall be responsible for work of this division. Contractor for this project will have scope of work associated with Division 25; see Electrical drawings and Process drawings for associated information.
- D. Provide Owner with original licenses for all copies of all software, for all equipment and systems provided in Division 25. Provide the Owner with software version and printed documentation of all documented programs, as part of Record Documents and Operation and Maintenance Manuals. Provide the Owner with all passwords required for full program access for all levels of PLC, PC, HMI, LAN and VPN network programming. The Owner shall have full legal right to use without restriction, and modify if they choose at their own risk, all programs, screens and reports prepared for this project, for their use in operating, maintaining, and managing their facilities.

1.2 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the startup and commissioning of SCADA and similar systems of types and sizes to this project, whose products have been in satisfactory use in similar service, and whose products meet all requirements specified herein.
- B. Installer: Qualified with successful installation experience on projects with field instrument work similar to that required for this project.
 - 1. It is intended that an experienced electronic systems/instrumentation and control systems subcontractor shall be in responsible charge of all field instrument work.

- C. ISA Compliance: Comply with applicable Standards and Practices for Instrumentation published by the Instrument Society of America pertaining to field mounted instruments and related installations.
- D. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical systems, and provide products and components which have been UL-listed and labeled whenever such UL listed products are available.
- E. NEC Compliance: Comply with requirements as applicable to construction and installation of field mounted instruments and installations.

1.3 SUBMITTALS

- A. Provide submittals in accordance with Section 25 13 00.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship instruments and accessories properly protected and packaged.
- B. Handle instruments and accessories carefully to prevent damage and protect from weather.

PART 2 PRODUCT

2.1 GENERAL

- A. For each system, provide a complete assembly with all required components, enclosures suitable for the environment and location, fittings, mounting brackets, and other components and accessories as needed to form a complete system.
- B. Provide conduit, raceway accessories, wiring and connections necessary to place the systems into service and necessary to interface the instruments to other equipment control panels, programmable controllers, SCADA system, and similar installations as required for the project.

2.2 DESKTOP SCADA PC

- A. Refer to Section 25 13 00 for computers and basic configuration of display screens.

2.3 NETWORKING

- A. Provide all necessary network setup and hardware to create a complete networked system between PLCs and SCADA computers.

B. Minimum requirements:

1. Provide in each specified PLC control panel an Ethernet switch with multiple ports to accommodate all equipment requiring Ethernet connection. The switch will be 10/100Mbps with auto-switching capabilities. Redlion or equal.
2. A spare Ethernet port will be available for future connection and troubleshooting.
3. Provide and setup a VPN connection to Main SCADA computer for Operator and Superintendent Connectivity over internet. Coordinate with town's IT personnel.

2.4 PROCESS CONTROLLERS

A. MANUFACTURERS

1. Allen-Bradley CompactLogix 5370 or 5380 Series.
2. No Substitutes.

B. GENERAL

1. Perform stand-alone monitoring and control and include following as minimum.
 - a. Microprocessor based controller (PLC processor) to execute program instructions, store data, and control data transfer.
 - b. PLC memory.
 - c. I/O subsystem interfaces.
 - d. Power supply, including power conditioning and surge protection.
 - e. Communication interfaces.
 - f. Programming interface.
2. Must integrate with any existing network of PLCs, ASDs, LOIs and HMIs.
3. Utilized as Main SCADA PLC networked to local panel mounted PC and HMI software. See drawings for list of IO and connectivity to field instruments and devices.

C. PLC PROCESSORS - COMPACTLOGIX 1769-L33ERM (System's Integrator may submit alternate AB CompactLogix unit for approval).

D.

1. Features:
 - a. 10/100Mbps, RJ-45, Ethernet I/P Communication Interface Card mounted in one of the two available Communication Card Slots in processor chassis.
 - b. Ladder, sequential function chart (SFC), structured text, and function block programming ready.

2. Provide orderly shutdown on power failure, saving register contents with automatic restart on power restoration.
 3. Interface to programmer unit for maintenance and troubleshooting. Continually update display when data requested. Provide capability to monitor or change following.
 - a. Discrete I/O.
 - b. Analog I/O.
 - c. Pulsed I/O.
 - d. Communication parameters.
 - e. Configuration data.
 - f. Internal program data values.
- E. PLC POWER SUPPLY - P4
1. 85-264 VAC.
 2. Sizing is responsibility of System Supplier.
- F. I/O MODULES
1. I/O modules specifically designed for interfacing of I/O signals to PLC processor. Screw-type removable wiring arms required for each I/O module are responsibility of System Supplier.
 2. Include sufficient I/O modules to accommodate I/O with provisions for 20% spare I/O prewired to terminal strips. Where no I/O of a listed type (digital input, digital output, analog input, analog output) is shown, provide one spare prewired module. Each processor or I/O chassis must contain a minimum of one spare slot, beyond the required spare I/O. Provide 1769-N2 filler strips for all empty slots in processor and I/O chassis.
 3. 120VAC Digital Input 1769-IA16
 - a. 120 VAC individually isolated as required by application.
 - b. 16 points per module.
 - c. LED indication of on/off status of each point.
 4. 120 VAC Digital Output 1769-OA16
 - a. 120 VAC non-isolated as required by application.
 - b. 16 points per module.
 - c. LED indication of on/off status of each point.
 - d. Interposing relay for each output point required.
 5. Analog Input 1769-IF4I
 - a. Individually isolated.
 - b. 6 points per module.
 - c. Accept 4-20 mAdc or 1-5 vdc inputs as required by application.

6. Analog Output 1769-OF4I

- a. Individually isolated.
- b. 6 points per module.
- c. Transmit 4-20 mAdc.

G. ETHERNET ADAPTER 1769-ENBT

1. Provides connectivity between SCADA system and PLC processors on Ethernet data highway.
2. 10/100 auto-switching.

H. COMMUNICATIONS SOFTWARE

1. Communication software and configuration shall meet monitoring and control requirements of each process in accordance with functional descriptions.
2. Within each hardware unit communicating over data highway, include executive routines or traffic controller to control and coordinate activities on communication links. Use integrated, standard products for communication software to manage transmission protocols, line error detection, and message switching.
3. Interface software for transfer of data from one location to another.
4. Expandable systems shall accommodate addition of future equipment as specified elsewhere.
5. Diagnostic facilities to check performance of communication links and communications interface portion of devices on data highway.
6. Include routines to detect transmission errors. Perform automatic re-interrogations and retransmissions before alarm is sounded. Generate system alarms.

2.4 SCADA SOFTWARE

- A. The new SCADA software package shall be iFix, latest version.
- B. Appropriate drivers shall be provided for communications to the Top View alarm package.

2.5 XL REPORTER

- A. Provide latest version of Dream Reports with templates to provide monthly reports for Supervisor admission.
- B. Develop datalogging reports for each flow rate in the plant. Flow rate data shall be collected on a per minute basis on a 24-hour period. Data shall be configured for a snapshot report based on date and time entered.
- C. Provide a minimum of three templates per Owner request that will meet EPA requirements.

2.6 TOP VIEW ALARM REPORTING PACKAGE

- A. General

1. Provide a minimum 100 point alarm package which supports voice, text and email for alarm notifications.
2. The alarming software shall be able to communicate to points on multiple OPC Servers simultaneously. It must be possible to search for points on the OPC Server through a GUI search utility if the OPC Server supports browsing.
3. Alarm Configuration
 - a. The system shall allow for the configuration of multiple alarm conditions per monitored point including value (HI, HIHI, LO, LOLO, equal to, not equal to, value flatline, value change, trend up, trend down) and timestamp age.
 - b. Each alarm condition must be able to compare the point value to a fixed limit or the value of another point in the system. Each limit must support a configurable delay after which a limit violation is considered a valid alarm condition, and delay after which a limit violation is considered not valid, and a deadband (alarm hysteresis).
 - c. The system must support the inheriting/templating of alarm limit settings in order to allow duplicate alarm limit and notification settings to be defined once and used by multiple points.
 - d. The system shall support the defining of alarm limits based on day of week and time of day.
 - e. The system must be able to suppress alarm detection if the quality of a point is not good.
 - f. The system must support the ability to suppress alarm detection if related equipment is not running. This automatic detection must be available through equipment state flags available in the OPC server.
 - g. Each alarm condition shall support custom colors for the alarm display and the ability to tie the color to the alarm priority.
 - h. The system shall allow the assignment of points/alarms to user-created categories. The categories must support a hierarchy of parent/child category names. The system must support the assignment of each point to one or more categories.
 - i. It shall be possible to create multiple groups of points with different, configurable update rates.
 - j. The system shall support the creation of custom alarms based on multiple points with compiled logic scripting
 - k. The system must allow the creation of alarms based on alarm frequency and active alarm count.
 - l. The system shall support the configuration of alarms and notification settings through a desktop application, web application, and configuration export/import using CSV files.
4. Display
 - a. The system shall be able to display the values of all monitored points including those in alarm and those not in alarm. It shall give the user the option to display only those points in alarm.
 - b. The system shall provide the display of all values and alarms through both desktop

applications and web browsers. Both platforms must support the real-time update of values and alarms to the client application (data push).

5. Actions

- a. The system must support the ability to remotely disable/shelve alarms and notification for a configurable period of time, either current or future, while the system is running.
- b. The system must allow remote users to query and filter alarm history as recorded by the system. The user must be able to store the results to an alarm report file.
- c. The system shall support local and remote users to add comments to current and historical alarms.
- d. The system shall support the request of point values and alarm states through Email and SMS.

6. Notification

- a. The system shall support notification of alarm limit violations through email. Email support must include the ability to send email through an SMTP mail server/SMTP. Support must include the ability to perform authorization/login and security through SSL/TLS as well as OAuth/modern authentication. The system must support the customization of the email subject. The message text must be able to include custom descriptive text of the alarm condition as well as a summary of all monitored point values and other existing alarm conditions.
- b. The system shall allow email notifications content to be templated as Text or HTML message content.
- c. The system must support sending alarm limit violations through SMS using a cellular modem/device and hosted service Twilio.
- d. The system must support delivery of alarm limit violations through voice call-out to any phone using hosted or internal VOIP systems including VOIP-to-analog bridges. The recipient of the call must be able to acknowledge the alarm using their phone keypad.
- e. The system shall support sending notifications for alarm active, alarm acknowledged, and alarm return-to-normal.
- f. The system must support the ability for email, and SMS notification recipients to acknowledge the alarm through email and/or SMS reply.
- g. The system must support the ability for alarm notification recipients to acknowledge the alarm through a web application. Notification messages must be able to direct the recipient to the web page URL to acknowledge the alarm for the notification received.
- h. The system shall be able to resend alarms (email, SMS and voice) after a configurable period of time.
- i. The system shall be able to escalate the alarm notifications after the alarm based on the state of an alarm active or acknowledge.
- j. It shall be possible to define notification recipients (email, phone number) through OPC string tags. If the value of the string tag is changed, the system must use the new value for future notifications.

- k. The system shall be capable of sending notification messages if connection to an underlying OPC Server is lost.
 - l. The system shall prioritize notification delivery based on alarm priority.
 - m. It shall be possible to manage contact information for notification delivery through local storage or Microsoft Active Directory user information.
 - n. The system must support redundancy of SMS devices and voice call VOIP/SIP servers
7. Logging and Reports
- a. It shall be possible for the alarm software to create web reports summarizing the current value and alarm state for all monitored points. The system must be able to transfer this file to a remote machine through FTP (file transfer protocol) and to send these reports via Email.
 - b. The system must support the automatic generation and emailing of alarm summary reports. These reports must include a log of the alarms that occurred over a configurable period of time as well as a summary information per point including alarm counts, average duration, and total duration.
 - c. The system shall be capable of logging all alarm violations, return to normal conditions, email and SMS messages, and their success status. The user should be able to configure a maximum size for the log files. A log file viewer utility should be able to filter messages according to message type and importance.
 - d. The system shall support the logging of all alarm violations to a SQL database.
 - e. The system must be able to export the current state of all point and alarms to both files and SQL tables that are updated by the system as state changes occur.
 - f. The system shall support a change log of all alarm configuration changes including the time and user who made the change
 - g. The system must support a backup of all configuration changes with the ability to restore a previous state of configuration
8. Execution
- a. The alarm software runtime shall be capable of running as a Windows Service.
 - b. The system shall be able to output a “watch-dog” signal back to a point on the OPC Server.
 - c. The software must support the real-time monitoring of execution details and performance through a desktop monitoring application.
9. The system must support a redundant installation with direct secondary-to-primary machine health monitoring
- 2.7 CELL MODEMS
- A. Provide a cell modem in the Main PLC control panel and the Garage Remote HMI panel. The cell modem shall be configured for tunneled security and only allow permissions for approved personnel to have access to the system.

- B. Coordinate with the Owner to obtain a SIM card for each cell modem from their service provider. Confirm correct operation and communications once the modems have been provisioned.
- C. Manufacturer:
 - 1. Sierra Wireless RV50X

END OF SECTION 25 30 20

(NO TEXT FOR THIS PAGE)

SECTION 26 00 00 – ELECTRICAL INDEX

26 05 00	Common Work Results for Electrical
26 05 19	Low-Voltage Electrical Power Conductors and Cables
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26 05 26	Grounding and Bonding for Electrical
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26 05 33	Raceways, Conduit, and Boxes for Electrical Systems
26 05 53	Identification for Electrical Systems
26 08 00	Power System Acceptance Testing
26 22 00	Low-Voltage Transformers
26 24 16	Panelboards
26 27 16	Electrical Enclosures and Controls
26 27 26	Wiring Devices
26 28 16	Disconnect Switches
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26 29 23	Variable-Frequency Motor Controllers
26 32 13.13	Diesel-Engine-Driven Generator Sets
26 36 23	Automatic Transfer Switches
26 56 00	Exterior Lighting
26 90 00	Heat Trace

(NO TEXT FOR THIS PAGE)

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The description of work is as described in the plan drawings and specifications.
- B. The Common Work Results for Electrical apply to all electrical materials, equipment, installations, and services supplied under any portion of the work. The Contractor shall coordinate the Common Work Results for Electrical as applicable to any equipment, installations, and services of an electrical nature.
- C. It is the intention of this Division of the Specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown on the plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the plans, but which are necessary to provide a complete working installation of all electrical systems shown on the plans or described herein. Equipment and devices furnished and installed under other Divisions of this specification (or by the Owner) shall be connected under this Division. The drawings and specifications are complementary and what is called for in either, is binding as if called for in both.
- D. The contract drawings indicate the extent and the general location and arrangement of equipment, conduit and wiring. The contractor shall study plans and details and shall cooperate with all other trades to prevent conflict and interference as to space requirements. Fixtures, equipment and outlets shall be located to avoid interference with mechanical or structural features. Lighting fixtures shall be symmetrically located according to the room arrangement. Raceways, junction and outlet boxes, lighting fixtures, and all other electrical equipment shall be properly supported to comply with applicable codes and good work practices.
- E. The Electrical Contractor is responsible for installation of a complete and operating electrical system in accordance with the intent of the drawings and specifications.
- F. The scale of drawings cannot show all necessary transitions, offsets, changes in direction, etc. It shall be the responsibility of the Electrical Contractor to provide all pull boxes, elbows, fittings, supports, etc. necessary to install his work to conform to structures, to preserve headroom and to keep openings and passageways clear.

- G. Electrical diagrams are schematic and diagrammatic only, not necessarily to scale, and do not necessarily show physical arrangement of equipment. Electrical diagrams and plans are complementary and what is shown on either is the same as if shown on both.
- H. The horsepower of motors and equipment wattages indicated on the plans are based on information made available to the Engineer and field notes of existing installation, and are as accurate as practical; however, there may be discrepancies. All wiring, switches, circuit breakers, magnetic motor starters, soft-starters, and variable frequency drives shall be of size and capacity to suit the horsepower of the motors and equipment actually furnished, and actually being connected; however, in no case shall wiring, switches, circuit breakers and motor starters and drives be of smaller capacity or size than those indicated on the drawings or specified unless approved, in writing, by the Engineer.
- I. Any minor changes in the location of all equipment, switchboards, panelboards, starters, fixtures, conduits, outlets, etc. from those shown on the plans shall be made without extra charge if so directed by the Engineer or Owner before installation.
 - 1. Minor changes in location shall be defined as within 15 feet in any direction, horizontally or vertically, from the location indicated on the drawings.
- J. Make detailed arrangements with the Owner for selected electrical service work and any/all shutdowns required.
 - 1. Provide temporary services: The Contractor shall be responsible for, and bear the cost of, all temporary service or equipment feeders which may be required.
 - 2. All shutdown and power transfer work must be closely scheduled with the Owner, approved in advance by the Owner, and at the convenience of the Owner; and shall be performed only with the Owner present and/or under direct/indirect supervision of the Owner.
 - 3. Power shutdowns and transfers must be scheduled with the Owner and all such shutdowns and transfers shall be scheduled at the Owner's convenience. At the Owner's discretion, work may be required to be performed on holidays, weekends, evenings, early mornings, and during similar non-standard work periods, without additional cost to the Owner.
 - a. The above requirement for performing work during non-standard work periods also applies to any work that can only be safely performed during a power shutdown.

1.3 PERMITS AND FEES

- A. This work shall include the procurement of, and payment for, all permits and fees required for the performance of the electrical work.

1.4 COORDINATION OF ELECTRICAL WORK

- A. Contract documents are diagrammatic in showing certain physical relationships, which must be established; such establishment and the final physical relationship is the exclusive responsibility of the Contractor.

1. Arrange electrical work in a neat, well-organized manner with conduit and similar services running parallel with primary lines of structures, and which shall maximize overhead clearance.
2. Locate operating and control equipment and arrange entire electrical work with adequate access for operation and maintenance, and in accordance with all applicable governing codes.
3. Advise other trades of openings required in their work, and scheduling cooperation required, for the subsequent move-in of large units of electrical work (equipment, conduits, pull boxes, etc.).

1.5 COORDINATION OF OPTION, SUBSTITUTIONS, AND ARRANGEMENT

- A. Where the contract documents permit the selection from several product options, and where it becomes necessary to authorize a substitution, do not proceed with purchasing until coordination of interface requirements has been checked and satisfactorily established.
- B. The Contractor will not be paid for cutting, patching, retrofitting, and finishing required for relocation of work installed due to interference and improperly located equipment.

1.6 QUALITY ASSURANCE

- A. In case of difference between building codes, state laws and federal laws, local ordinances, industry standards and utility regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Engineer in writing of any such difference.

1.7 NON-COMPLIANCE

- A. Should the Contractor perform any work that does not comply with the requirements of the applicable building codes, state and federal laws, local ordinances, industry standards and utility regulations, they shall bear all costs in correcting all deficiencies.
- B. Applicable codes and standards shall include all the state laws, local ordinances, utility company regulations and the applicable requirements of the following nationally accepted codes and standards. All of the following codes shall apply to the equipment, and equipment installation, where applicable. All equipment shall bear U.L. labels where labeled equipment is available.
- C. Industry Standards, Codes and Specifications
 1. NEC National Electrical Code (NFPA No. 70) with State Amendments
 2. UBC International Building Code with State Amendments
 3. ANSI C2 National Electrical Safety Code.
 4. IEEE Institute of Electrical and Electronics Engineers.
 5. ASTM American Society of Testing Materials.
 6. IPCEA Insulated Power Cable Engineers Association.
 7. NEMA National Electrical Manufacturers Association.
 8. NFPA National Fire Protection Association.
 9. UL Underwriters Laboratories.

10. NECA Standard of Installation, National Electrical Contractor's Association.
11. NFPA No. 101 Life Safety Code.
12. FM Factory Mutual
13. ADA Americans with Disabilities Act

- D. All electric materials shall be new, in original cartons, bundles, or shipping crates and shall have a U.L. label whenever available.
- E. Nothing in these drawings and specifications shall be construed to permit work not conforming to governing codes; and shall not be construed as relieving the Contractor from complying with any requirements of the plans or specifications which may exceed requirements of the hereinbefore mentioned governing codes and rules and not contrary to same.

1.8 MANUFACTURERS

- A. Firms regularly engaged in the manufacture of the equipment specified of the types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years, unless specified otherwise.

1.9 INSTALLERS

- A. A firm with at least 5 years of successful installation experience on projects with electrical work similar to that required for the project, unless specified otherwise.

1.10 SUBMITTALS

- A. General: Provide submittals, shop drawings and descriptive data for selected items, and obtain Engineer's approval of same prior to proceeding with work.
- B. Submittals shall include, but not be limited to, information on the following:
1. Switchboards/Power Distribution Panelboards.
 2. Switchboard/Power Distribution Circuit Breakers.
 3. Switchboard/Power Distribution Panelboard Customer Metering.
 4. Motor Starters, Soft-Starters, and Variable Frequency Drives.
 5. VFD Accessories, such as Line and Load Reactors.
 6. Disconnect Switches and Enclosed Circuit Breakers.
 7. Transformers.
 8. Lighting Fixtures.
 9. Diesel Engine Driven Generators.
 10. Automatic Transfer Switches.
 11. Heat Tracing.
 12. Custom Control Panels, if not otherwise provided by the Division 25 Contractor.
 13. Testing and Commissioning Reports as part of Closeout.
 14. Full Documentation of Programming and Licensed Copies of Software, as applicable, as part of Closeout.
 15. Documentation of Training Conducted and Training Manuals.

16. Record Drawings (marked prints) of As-Built Conditions (for CAD drafting by the Engineer.
17. Operation and Maintenance Manuals, as part of Closeout.
18. Sketches of Equipment Mounting Racks with Equipment Locations, prior to shop or field fabrication. Use equipment shop drawings for dimensions and weights needed.
19. Equipment ID Nameplates and Nameplate List.

C. Submittals shall comply with the following:

1. Include complete catalog information such as construction, ratings, and insulating systems, wiring diagrams, description of operation, etc., as applicable.
2. For any material specified to meet U.L. or trade standards, furnish manufacturer's or vendor's certification that material furnished for work does in fact equal or exceed Specifications.
3. Shop drawings shall be submitted in complete groups of material (i.e., all fixtures or all switchgear, panels, etc.), and each item of material submitted shall have Contractor's stamp and be initialed by Contractor as verification that submittal has been reviewed in detail and is in fact Contractor's choice of materials. Bind catalog cuts, descriptive bulletins, and drawings, 11" x 17" or smaller, in sets with covers showing titles. Contractor shall verify dimensions of equipment and be satisfied as to code compliance for fit prior to submitting shop drawings for approval. Departure from the above noted procedure would result in rejection of the submittal and the requirement that the Contractor revise and resubmit the information. Any costs associated with delays arising out of such resubmittal process shall be the sole responsibility of the Contractor.

1.11 O&M MANUALS

- A. Submit three sets of Operation and Maintenance Manuals.

1.12 WARRANTIES

- A. All new equipment shall have a warranty of one (1) year, including all parts and labor.

END OF SECTION 26 05 00

(NO TEXT FOR THIS PAGE)

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of electrical wire and cable work is indicated by the project drawings.
- B. Types of wire, cable and connectors specified in this section include the following:
 - 1. 600-volt insulated Copper conductors.
 - 2. Fixture wires.
 - 3. Tap-type connectors.
 - 4. Mechanical and compression connectors.
 - 5. Twist-on insulated metal spring connectors.
- C. Signal, instrumentation, and control type wire and cable products are not part of this Section.
- D. Applications of electrical wire, cable, and connectors required for project are as follows:
 - 1. For power distribution circuitry.
 - 2. For branch-circuit appliances and equipment.
 - 3. For 120VAC and 24VAC control circuits.

1.2 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical wiring and cabling work similar to those required for project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation; and color coding of electrical wires and cable.
- D. UL Compliance: Comply with applicable requirements of UL Std. 83, "Thermoplastic-Insulated Wires and Cables", and Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," except where manufacturer's torque-tightening requirements are more stringent.
- E. UL Labels: Provide wiring/cabling and connector products that are UL listed and labeled.
- F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std Pub/No.'s WC 5, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy," and WC-30, "Color Coding of Wires and Cables," pertaining to electrical-power-type wires and cables.

- G. IEEE Compliance: Comply with applicable requirements of Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- H. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20 Deg.C.(68 Deg. F.).

1.3 STANDARDS

- A. All materials shall be new, manufactured in accordance with latest edition of UL, NEMA, ANSI, and IPCEA.
- B. All cables furnished shall be of same type and by same manufacturer. All accessories of a particular type shall be by the same manufacturer.

1.4 SUBMITTALS

- A. Submit shop drawings for wire, connectors, and related products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type non-returnable wire and cable reels.
- B. Store wire and cable in clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing, or tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.1 ACCEPTABLE 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. Wire and Cable:
 - a. American Insulated Wire Corp.
 - b. Brand-Rex Div; Pyle National Co.
 - c. Cerro Wire and Cable Co.
 - d. Hitemp Wires, Inc.
 - e. Phelps Dodge Cable and Wire Co.
 - f. Pirelli Cable Corp.
 - g. Rome Cable Corp.

h. Southwire Company.

2. Connectors:

- a. AMP, Inc.
- b. Burndy Corporation
- c. Brand-Rex Div., Pyle National Co.
- d. General Electric Co.
- e. 3M Company
- f. O-Z/Gedney Co.
- g. Square D Company
- h. Thomas and Betts Corp.

2.2 WIRES, CABLES AND CONNECTORS

- A. General: Provide electrical wires, cables and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated.
- B. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20 Deg. C (68 Deg. F).
 - 1. For this project, Aluminum conductors may be used for power circuits 150 Amperes and larger, if the aluminum conductor AWG size is equivalent to a copper conductor.
 - 2. All equipment ground conductors shall be copper; no exceptions.
- C. Wires: Provide factory-fabricated wire of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements. Conductors shall be annealed copper.
 - 1. Type THWN-THHN, XHHW-2: For dry and wet locations; max dry location operating temperature 90 Deg. C. Insulation shall be flame-retardant, moisture-resistant and heat-resistant thermoplastic; outer covering shall be nylon jacket.
 - a. Apply conductors at 75 deg. C. ampere rating for circuits greater than 100 amperes. Use 60 deg. C. ampere rating for circuits 100A or less.
 - b. Provide XHHW-2 type wiring on the load-side of variable frequency drives or as specified in the drawings.
 - 2. Minimum Control Circuit AWG size: #14.
 - 3. Minimum Power Circuit AWG size: #12.
 - 4. Increase AWG size as needed to keep total voltage drop less than or equal to 5%.

2.3 CONNECTORS

- A. General: Provide UL-type factory-fabricated, metal connectors of sizes, ampacity ratings, material, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements, NEC and NEMA standards. Ensure connector materials mate and match and are compatible with conductor materials and cables. Select from the following types:
1. Type: Insulated mechanical-bolted parallel or compression type for feeders and generator circuits; twist-on insulated metal spring connectors for #12 and #10 AWG miscellaneous branch circuit wiring, including equipment ground conductors.
 2. Material: Copper (for Cu to Cu connection) or CU/AL type.
 3. Insulation: All connectors shall be fully insulated to match insulation type and rating of conductors being spliced.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation," and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation with electrical raceway and equipment installation work, as necessary.
- C. Install all wiring in conduit.
- D. Pull conductors together where more than one is being installed in a raceway.
- E. Use pulling compound or lubricant, where necessary. Compound must not deteriorate conductor or insulation. Use of soap is not permitted as a pulling lubricant.
- F. Use pulling means, including fish tape, cable, rope and basket-weave wire/cable grips that will not damage cables or raceway.
- G. Keep conductor splices to a minimum.
- H. Install splices and tapes that possess equivalent-or-better mechanical strength, electrical ampacity, and insulation ratings than conductor being spliced.
1. Use heat-shrink or cold-shrink splice kits for feeder circuit splices.
- I. Use splice and tap connectors that are compatible with conductor material.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements

are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.

- K. Use twist-on insulated metal spring connectors for #14 control and #12 and #10 AWG branch circuit wiring, including equipment ground conductors.
- L. Pull in a properly sized green color 600VAC insulated copper equipment ground wire with all conduit runs, including PVC, metal conduits, and flexible conduits.

3.2 FIELD QUALITY CONTROL

- A. Prior to energizing circuitry, check installed service and feeder wires and cables with megohm meter to determine insulation resistance levels, to ensure insulation integrity.
- B. Prior to energizing, test wires and cables for electrical continuity and for short-circuits. Test branch circuit wiring with ohmmeter.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, replace faulty conductors and retest to demonstrate compliance.
- D. Ensure correct rotation of all motors.
- E. Ensure correct sequence of phases at all switchgear and panelboards. Phase-sequence testing shall be performed in the presence of the Owner and Engineer, on both high-voltage and low-voltage systems, on both existing and new equipment. Ensure all phases of all circuits are identified. Ensure proper rotation of all motors. Ensure phase sequence of tie circuit(s) and both sides of secondary unit substation are exactly the same (as applicable). Provide A-B-C phase arrangement, left-to-right, top-to-bottom.

END OF SECTION 26 05 19

(NO TEXT FOR THIS PAGE)

SECTION 26 05 23 - INSTRUMENTATION CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install instrumentation cable. The types of cable include the following:
 - a. Shielded and Jacketed Instrument Cable.

1.2 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's technical information for instrumentation cable proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Single Shielded Pair Instrument Cable:

1. Tinned copper, polyethylene insulated, stranded conductors, No. 16 AWG minimum, twisted with aluminum-polyester shield, stranded tinned No. 18 AWG copper drain wire and overall chrome PVC jacket. Rated for 600 volts minimum.
2. Manufacturer: Provide one of the following:
 - a. Belden 8719
 - b. Or approved equal.

B. Multipaired Shielded Instrument Cable:

1. Tinned copper, 7 strand insulated conductors, No. 16 AWG minimum, twisted in pairs with aluminum-mylar shield over each pair, silicone rubber fiberglass fire barrier tape, tinned copper drain wire, aluminum mylar overall shield, outer jacket.
2. Manufacturer: Provide one of the following:
 - a. Belden Company
 - b. Okonite Company.
 - c. Dekoron Wire and Cable Company.

d. Or approved equal.

C. Multiconductor Shielded Instrument Cable:

1. Tinned copper, stranded conductors, No. 16 AWG minimum, with overall aluminum-polyester shield with 85 percent tinned copper braid shield and overall teflon jacket.
2. Manufacturer: Provide one of the following:
 - a. Belden Company.
 - b. Okonite Company.
 - c. Or approved equal.

D. Cable Terminals:

1. Fork type copper compression terminals with nylon insulation for termination of cable at all terminal blocks.
2. Product and Manufacturer: Provide one of the following:
 - a. T&B Sta-Kon.
 - b. Burndy Insulug.
 - c. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all cable complete with proper terminations at both ends.
- B. Install instrumentation cables in conduit separate from power and control cables unless otherwise noted.
- C. Ground the shield on shielded cables at one end only and as recommended by instrument manufacturer.
- D. Identify all conductors in accordance with electrical identification specifications.
- E. Install and terminate vendor furnished cable in accordance with vendor equipment requirements and cable manufacturer's specific recommendations.
- F. Install in conformance with the National Electrical Code.

3.2 TESTING

- A. Test shielded instrumentation cable shields with an ohmmeter for continuity along the full length of the cable and for shield continuity to ground.
- B. Connect shielded instrumentation cables to a calibrated 4-20 milliamp DC signal transmitter and receiver. Test at 4, 12, and 20 milliamp transmitter settings.

- C. Any cable which fails any test or when used under full load conditions shall be replaced with a new cable for the full length.

END OF SECTION 26 05 23

(NO TEXT FOR THIS PAGE)

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Extent of electrical grounding and bonding work is indicated by drawings as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.
- B. Refer to other Division 26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.
- C. The electrical service will be 3 Phase, 4 Wire, WYE, and the grounded service conductor (neutral conductor) provided by the electrical utility company shall be brought to the main disconnect switch/main circuit breaker and be solidly grounded. The neutral may not be used in the facility (refer to One-Line Diagram), but an equipment ground conductor shall be installed in all conduits on the load side of main disconnect (load side of neutral-to-ground bond location) or as specified in the drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):
 - 1. Burndy Corporation.
 - 2. Cadweld Div.; Erico Products Inc.
 - 3. Crouse-Hinds Div.; Cooper Industries.
 - 4. Ideal Industries, Inc.
 - 5. Joslyn Corporation.
 - 6. Okonite Company.
 - 7. OZ Gedney Div.; General Signal Corp.
 - 8. Thomas and Betts Corp.

2.2 GROUNDING AND BONDING

- A. General: Except as otherwise indicated, provide electrical grounding and bonding systems; with assembly of materials, including, but not limited to, wires, connectors, solderless lug terminals, grounding electrodes bonding jumper braid, and additional accessories needed for a complete installation. Where more than one type of component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products

- B. which comply with NEC, UL, NEMA, IEEE requirements, and with established industry standards for those applications indicated.
- C. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match building wiring materials and are sized according to NEC.
- D. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.
- E. Field Welding: Comply with AWS Code for procedures, appearance, and quality of welds; and for methods used in correcting welding work. Provide exothermic type or equal welded connections where grounding conductors connect to underground grounding electrodes and underground or under slab or encased metal structural components.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that installations comply with requirements.
- B. Coordinate with other work as necessary to interface installation of electrical grounding and bonding system.
- C. Weld grounding conductors to underground grounding electrodes.
- D. Connect together by equipment ground conductors and bonding, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, equipment frames, structural steel.
- E. For antenna towers, provide grounding and ground rod for lightning protection and bond the tower ground system to the electrical ground rod system provided for the electrical service.
- F. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug.
 - 1. All feeder and branch circuits shall have a green insulated equipment ground conductor. (Ground conductors may not be indicated on plans, but shall be provided).
- G. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque values for connectors and bolts. Where

manufacturer's torquing requirements are not indicated, tighten connections to comply with

- H. tightening torque values specified in UL 486A to ensure permanent and effective grounding.
- I. Route grounding connections and conductors to ground and Surge Protective Devices in shortest and straightest paths as possible to minimize transient voltage rises.
- J. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

3.2 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms or less, by driving additional ground rods; then retest to demonstrate compliance. Submit test report.
- B. Use ohmmeter and test for continuity of all ground conductors, all metallic raceways and enclosures, metallic building structure, and metallic piping. Submit test report.

END OF SECTION 26 05 26

(NO TEXT FOR THIS PAGE)

SECTION 26 05 29 – SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Conduit and equipment supports
- B. Anchors and fasteners

1.2 REFERENCES

- A. NECA - National Contractors Association
- B. National Fire Protection Association, (NFPA)
 - 1. ANSI/NFPA 70 - National Electrical Code

1.3 SUBMITTALS FOR REVIEW

- A. Product Data: Provide manufacturer's catalog data for fastening and support systems.
- B. Submit sketches of mounting frames and racks indicating proposed construction.

1.4 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Project record documents

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance for the environment in which the products will be installed.
- B. All hardware installed in Class 1, Division 1 and 2 environments shall be stainless steel.
- C. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- D. Anchors and Fasteners, Unless Otherwise Indicated
 - 1. Concrete Structural Elements: Use expansion anchors.
 - 2. Steel Structural Elements: Use beam clamps and welded fasteners.
 - 3. Concrete Surfaces: Use expansion anchors and self-drilling anchors.
 - 4. Concrete Hollow Core Slab Units
 - a. For fixtures and ancillary conduit, 50 lbs (22 kg) Maximum use toggle bolts in hollow cells.
 - b. For heavier items use through-bolts in hollow cells with bearing plates on top surface.
 - 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 6. Solid Masonry Walls: Use expansion anchors.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood Elements: Use wood screws.

2.2 MOUNTING CHANNELS

- A. Manufacturer: Any of the following manufacturers are approved for use. Use the products of only one manufacturer.
 - 1. Unistruct Corp.
 - 2. B-Line Systems.
 - 3. Joslyn Corp.
- B. Description: Galvanized steel unless heavy-weight aluminum is noted on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."

- C. Support frames and anchors for mounting equipment to be furnished by the Contractor and approved by the Engineer. Provide channel hardware, angle brackets, foot brackets, and other fasteners and manufactured accessories as needed for a heavy-duty rack capable of supporting the equipment weight without bowing and resistive to movement in all directions. Heavy-duty equipment racks that will endure outdoor weather for 30+ years are required.
- D. Raceway surface mounted: Support by one-hole, cadmium plated, malleable iron clamps with clamp backs which provide clearance between the raceways and the mounting surface.
- E. Raceway surface mounted: Support by trapeze, ring, or clevis hangers. Supports for raceways 2-inch and smaller shall be cadmium plated adjustable swivel ring hangers, and for larger raceways supports shall be galvanized adjustable clevis type hangers.
- F. Provide PVC coated fasteners and supports where coated conduit is installed.
- G. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- H. Do not use spring steel clips.
- I. Do not use chain, wire, or perforated strap hangers.
- J. Do not use powder-actuated anchors.
- K. Obtain permission from Engineer before drilling or cutting structural members.
- L. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- M. Trapeze hangers shall be structural channels, angle irons, or pre formed channel shapes with raceways held in place by U-bolts, clips, or clamps. Hangers shall have edges ground and dressed and shall be hot dipped galvanized after fabrication. Preformed channels shall be not less than 1-5/8 x 1-5/8 inches by 14-ga, and field cut edges shall have end caps.
- N. Fastenings shall be wood screws to wood; toggle bolts to hollow masonry walls; expansion bolts to concrete or solid masonry walls; and machine screws, welded threaded studs, or spring tension clamps to steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts, machine screws, or wood screws.
- O. Expansion anchors shall be steel wedge type not less than 1/4-inch size. They shall extend at least 3 inches into concrete or masonry.
- P. Power set fasteners shall be not less than 1/4-inch size and shall extend at least 1-1/4 inches into concrete.

- Q. Inserts in concrete walls and slabs to support raceways shall be provided under this Section. Inserts for individual hangers shall be galvanized malleable iron and shall include removable nuts held in place by V-type teeth on the inserts. Continuous slotted channel inserts shall be galvanized steel with integral anchors at 6-inch centers. Factory finished steel snap on cover plates shall be provided on channel inserts between support attachments.
- R. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- S. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.
- T. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- U. Hanger rods if applicable shall be of adequate size, not less than 3/8-inch, galvanized, and furnished in the quantity shown in the following tabulation:

<u>6 Length Of Hanger, Inches</u>	<u>Number Of Bolts Or Rods</u>
36 And Less	2
37 Thru 48, Inclusive	3
49 And Greater	4

- V. Space supports for exposed rigid conduit as follows:

<u>Conduit Size Inches</u>	<u>Number Of Conduits</u>	<u>Maximum Spacing Of Supports, Feet</u>	
		<u>Horiz</u>	<u>Vert</u>
3/4	1 or 2	10	7
	3 or more	7	7
1 & 1-1/4	1 or 2	12	8
	3 or more	9	8
1-1/2 And Larger	1 or 2	14	10
	3 or more	12	10

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS, CONDUIT, AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The work required under this section includes the provision, fabrication, and installation of all raceways and conduit required for this Work.
- B. This section covers all conduit to be used on the various portions of the project and the Contractor shall meet the requirements of these Specifications wherever applicable.

1.2 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service, and whose products meet all requirements specified herein.
- B. Installer: Qualified with successful installation experience on projects with electrical raceway work similar to that required for this project.
 - 1. An experienced journeyman shall be in responsible charge of all raceway and conduit work.
- C. NECA Compliance: Comply with applicable NECA standards pertaining to raceways.
- D. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical raceway systems, and provide products and components, which have been UL-listed and labeled.
- E. NEC Compliance: Comply with requirements as applicable to construction and installation of raceway systems.

1.3 SUBMITTALS

- A. Shop drawing submittals are not required.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Provide end-cap thread protectors on exposed threads of threaded metal conduit.
- B. Handle conduit and raceways carefully to prevent bending and end-damage and to avoid scoring finish.
- C. Store conduit and tubing inside and protect from weather. When necessary to store outdoors, elevate well above grade and enclose with durable, watertight wrapping.

PART 2 - PRODUCT

2.1 GENERAL

- A. For each electrical raceway system provide a complete assembly of conduit with all required fittings; including, but not necessarily limited to, connectors, nipples, couplings, elbows, expansion fittings, pull boxes and other components and accessories as needed to form a complete system.
- B. Provide conduit, and raceway accessories including straps, hangers, angles, support chairs, etc. as required for a complete system.

2.2 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Liquid-tight flexible metal conduit shall comply with Fed. Spec. WW-C-566 and shall be minimum 3/4" trade size, U.L. listed, standard weight, flexible, galvanized zinc-coated and PVC jacketed steel conduit.
- B. Fittings shall be designed for use with liquid-tight flexible steel conduit and shall maintain electrical continuity throughout fittings and conduit. Fittings shall comply with Fed. Spec. W-F-406, Type 1, Class 1, Style A.

2.3 RIGID ALUMINUM CONDUIT (Not Used for this project)

- A. Rigid aluminum conduit shall be 6063 alloy, T41 temper, complying with ANSI C80.5 and Fed. Spec. WW-C-540 and shall be UL 6 listed.
- B. Elbows, bends, and similar offsets shall be made of full weight material complying with the above and shall be coated and threaded the same as conduit.
- C. Threads for conduit, couplings, and fittings shall be full depth and clean cut.
- D. Conduit shall be 3/4" trade size or larger or as indicated on the drawings or as required for the application if not indicated, and shall be manufactured by VAW, or equal.
- E. Rigid aluminum conduit fittings shall comply with Fed. Spec. FS W-F-408.
- F. All couplings and fittings shall use threaded connections. Do not use any non-threaded fittings or connections.

2.4 GALVANIZED RIGID STEEL (GRS) CONDUIT

- A. Rigid metal conduit shall be mild steel, hot-dip-galvanized conduit complying with ANSI C80.1 and Fed. Spec. WW-C-581E and shall be U.L. listed.

- B. Elbows, bends, and similar offsets shall be made of full weight material complying with the above and shall be coated and threaded the same as conduit.
- C. Threads for conduit, couplings, and fittings shall be full depth and clean cut.
- D. Conduit shall be 3/4" trade size or larger or as indicated on the drawings or as required for the application if not indicated, and shall be manufactured by National Electrical Products Company, Youngstown Steel and Tube Company, Republic Steel, Allied Steel Tube and Conduit Company, or equal.
- E. Rigid metal conduit fittings shall comply with Fed. Spec. FS W-F-408.
- F. All couplings and fittings shall use threaded connections. Do not use any non-threaded fittings or connections.

2.5 INTERMEDIATE METAL CONDUIT (Not used for this project)

- A. Intermediate metal conduit shall be mild steel, hot-dip-galvanized conduit complying with ANSI C80.6 and Fed. Spec. WW-C-581E and shall be U.L. listed.
- B. Elbows, bends, and similar offsets shall be made of full weight material complying with the above and shall be coated and threaded the same as conduit.
- C. Threads for conduit, couplings, and fittings shall be full depth and clean cut.
- D. Conduit shall be 3/4" trade size or larger or as indicated on the drawings or as required for the application if not indicated, and shall be manufactured by National Electrical Products Company, Youngstown Steel and Tube Company, Republic Steel, Allied Steel Tube and Conduit Company, or equal.
- E. Intermediate metal conduit fittings shall comply with AA-50553 (replaces Fed. Spec.)
- F. All couplings and fittings shall use threaded connections. Do not use any non-threaded fittings or connections.

2.6 ELECTRICAL METALLIC TUBING (EMT)

- A. Electrical metallic tubing shall be mild steel, hot-dip-galvanized, complying with ANSI C80.1 and Fed. Spec. WW-C-581 and shall be U.L. listed.
- B. Elbows, bends, and offsets shall be made from full weight material complying with the above and shall be coated the same as electrical metallic tubing. Use compression or set screw fittings.
- C. All EMT fittings shall be steel. Cast fittings will not be allowed.
- D. Electrical metallic tubing size shall be minimum 3/4" trade size or as indicated on the Project Drawings and/or as specified herein.

2.7 RIGID NONMETALLIC CONDUIT (Use Schedule 40 PVC for this project)

- A. Electrical Plastic Conduit: NEMA Stds. Pub. No. TC2, Type 3, Schedules 40 or 80 as shown on drawings, for direct burial, manufactured from ASTM D1784 PVC in compliance with NEMA TC2. PVC conduit shall be UL listed. Joints shall be solvent cement types.
- B. Provide PVC elbows, bends, fittings, and adapters as required for a complete installation. PVC conduit and tubing fittings shall comply with NEMA Stds. Pub. No. TC3, match to conduit/tubing type and material. Provide solvent cement as recommended by the conduit manufacturer.
- C. Conduits turning up out of the ground shall have galvanized steel elbows and extensions.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install raceway products as indicated on the drawings and as required, in accordance with respective manufacturers written instructions, applicable requirements of the NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products serve their intended function.
- B. Conduit field joints shall be cut square and reamed smooth. Threads shall be cleanly cut and joints drawn up tight. No running threads will be permitted.
- C. Offsets and bends shall be made carefully, without reducing cross sectional area, and shall not be less than the radius of standard elbows. Offsets for rigid nonmetallic conduit shall be made with an approved heating apparatus; open flame heating of the conduit shall not be allowed.
- D. Conduits shall be supported from the structural system, not from ceilings, ductwork, piping systems or other non-structural items. Provide support for junction and pull boxes as required by the NEC.
- E. Support single conduit runs by means of rods and hangers. Support multiple runs in a similar manner or use a common trapeze hanger or unistrut channel hanger as required for span and loading. Provide end caps for trapeze type hangers.
- F. Conduits surface mounted on walls up to a height of 8' above the floor shall be supported by two-hole galvanized straps. Pinch type hangers may be used at heights greater than 8' above floor. Secure supports by means of toggle bolts, inserts, or expansion bolts.
- G. All spare conduits shall have a poly pull-string installed and available at each end for future conductor installation.
- H. Wherever possible, install horizontal raceway runs above water and steam piping.

- I. All conduit runs shall be grounded in an effective and approved manner at point of origin and shall maintain a continuous ground throughout all runs, cabinets, pull boxes, and fittings from the point of service to all outlets.
- J. All runs shall be completed and cleaned and free from foreign matter inside before the conductors are drawn in. During the installation, conduit ends are to be plugged or capped to prevent the entrance of foreign materials.
- K. Conduit supports shall be spaced in accordance with the NEC. Additionally, support PVC conduits every 3 feet.
- L. Conduit fittings shall be made for the respective conduit type and shall be used as required to keep conduit as close as practical to the surface or structure to which conduit is mounted.
- M. Coordinate with other work as necessary to interface installation of electrical raceways and components with other work.
- N. Level and square raceway runs, and install at proper elevations/heights.

3.2 RACEWAY USAGE

- A. For this project, all below grade conduit shall be SCH. 40 PVC. All transitions (90-degree elbow) from below grade to above grade shall be galvanized rigid steel. All above grade outdoor conduits shall be galvanized rigid steel. Coat all steel conduits where in contact with earth or concrete with oxidation resistant coating.
- B. Above the floor conduits inside the Electrical Room shall be EMT type.
- C. All conduit installed in a Class 1, Division 1 or Division 2 area shall be Galvanized Rigid Steel Conduit.
- D. All conduits inside Polymer Building, and or other Chemical locations shall be Sch 40 PVC; Support PVC every 3'.
- E. Conduits inside the meter/valve vault at the clarifiers may be EMT or Sch 40 PVC.
- F. Conduits inside the Blower Buildings/Sheds may be EMT or Sch 40 PVC.
- G. See plan sheets for additional conduit type requirements.

3.3 SEISMIC REQUIREMENTS

- A. Raceway installation for the work shall meet all applicable code seismic requirements.

3.4 BOXES AND FITTINGS

- A. Boxes and fittings shall match the conduit type. Provide cast metal boxes with threaded hubs for GRS applications; sheet steel boxes for EMT; PVC boxes for PVC conduit, etc.

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS

- A. Current editions of publications of the following institutes, are referred to in this section.
 - 1. American National Standards Institutes, ANSI.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. Nameplates: Engraved plastic laminate.
- B. Letters of nameplates shall be white and a minimum of 3/16" high. Color of nameplate shall be black, unless otherwise noted or indicated; with stainless steel fasteners.
- C. Wire/cable tags shall be self-adhesive wrap-around vinyl cloth; Brady, Ideal, or approved equal.

PART 3 - EXECUTION

3.1 NAMEPLATES

- A. Provide engraved laminate nameplates on all of the following devices listing the equipment name, equipment controlled or served and the circuit number.
 - 1. Main Fused Switch/Main Circuit Breaker.
 - 2. Switchboards/Power Distribution Panelboards.
 - 3. Control panels, variable frequency drives, motor starters and contactors.
 - 4. I & C PLC Panels.
 - 5. Pump Control Panels.
 - 6. Branch Circuit Panels.
 - 7. Automatic Transfer Switch.
 - 8. Dry-Type Transformers.
 - 9. Other major equipment and components.
- B. On the inside of each box indicate the circuit number of the circuit serving the device by using a cable tag.
- C. In pull boxes, and within switchboards, panelboards, motor starters, switches, etc. and at the equipment served by the circuit or feeder, on each cable of feeder circuits, and on each cable of all motor circuits, provide a cable tag identifying circuit number and phase.

D. All Instrument and Control wires and cables shall be similarly tagged as noted above.

E. Provide material submittal and a list of all nameplates for review.

END OF SECTION 26 05 53

SECTION 26 08 00 - POWER SYSTEM ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

- A. Procure the services of an acceptable independent testing Engineer to provide necessary test equipment and field test all power distribution work, including the following equipment and system components, and record and report the results.
 - 1. Ground electrode systems and equipment bonding.
 - 2. Testing of cables, 600V class and 15KV class (testing of 15KV class cables is not required for this project; by Utility Company).
 - 3. Megger testing of switchgear, transformers, switchboards, and panels.
 - 4. Phase sequencing of cables, transformers, switchgear, switchboards and panels.
 - 5. Test power circuit breaker operation.
 - 6. Determine power circuit breaker trip set-points and time delays to provide short circuit protection and coordination. Make breaker adjustments accordingly.
 - a. The Engineer will provide a list of the set-points and time-delays.
 - b. Contractor shall adjust the overcurrent devices per the list.
 - c. Do not energize the power system if set-points and time delays have not been made.
 - 7. Apply Arc Flash Hazard Labels.
 - a. The Engineer will provide the arc flash labels.
 - b. The Contractor shall affix the labels to the equipment.
- B. Replace all work and equipment found to be defective under tests and repeat specified tests on replaced work.
- C. Testing Objectives:
 - 1. Determine that the cables and equipment involved may be energized for final operational tests.
 - 2. Assure that the methods and materials used in manufacturing and installation have provided a power system that is in a safe and operable condition consistent with accepted industry standards.

D. Qualifications:

1. Electrical Contractor or Independent Testing Engineer: engaged in the business of electrical acceptance testing, similar to the inspections and tests specified; have a minimum of three (3) years experience.

E. Test Report:

1. Test Report: Provide a certified report including the following items:
 - a. Summary of the project.
 - b. Description of inspections performed.
 - c. Description of cables and installation.
 - d. Description of tests performed.
 - e. List of test equipment used and calibration dates.
 - f. Test results.
 - g. Conclusions and recommendations.
2. Where modifications, or repairs are made in order to meet system specifications, the test results and report shall indicate the final "as installed" condition.
3. Test Forms: acceptable equivalent to NETA copyrighted test report forms; include but not be limited to the following data;
 - a. Nameplate catalog number, serial number and rating.
 - b. Desired performance or performance range.
 - c. Measured performance.
 - d. Test equipment used.
4. Test personnel and date.
5. Any discrepancies or repairs made.
6. Environmental and physical conditions.

F. Scheduling:

1. Due to installation scheduling of specific items or for other valid reasons, testing may be subdivided into several small packages. In that case, one certified copy of a test report shall be submitted no later than thirty (30) days after completion of each test package and an inclusive test report containing the package reports shall be submitted in the quantity and within the time specified for the complete report.

PART 2 - PRODUCTS

(Not used.)

POWER SYSTEM
ACCEPTANCE TESTING

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PART 3 - EXECUTION

3.1 TESTING METHODS

A. Test Procedure:

1. Utilize project electrical documents to assist in ascertaining the extent of the project testing.
2. Provide necessary test equipment and be responsible for setting-up test equipment, wire checks of factory wiring, and all other preliminary work in preparation for electrical acceptance tests.
3. Test in cooperation with other affected contractors. Schedule of tests shall be coordinated with work of other contractors and Owner's operations, and approved by Owner prior to testing.
4. Advise manufacturer's representative of tests to be performed on their products, prior to testing, to permit them to witness the test should they so desire.
5. Test in the presence of representatives of the Owner and the Engineer at the option of respective representatives. Contractor shall advise time of test 48 hours in advance.
6. Tests shall be non-destructive and shall not exceed the manufacturer's recommended limit for the products being tested. Method of testing cable shall have approval of cable manufacturer and shall conform to all applicable standards of IPCEA.
7. Where required for the validity of tests or safety of equipment and personnel, isolate equipment to be tested from the system.
8. Report immediately to Engineer all systems, materials or workmanship which is defective or not in compliance with the specifications.

B. Visual Inspection:

1. Prior to testing, the installation shall be visually inspected to determine that there is no physical damage, that there are no loose or missing parts, and that products supplied are in agreement with the contract documents and properly installed and connected.

C. Environmental Conditions:

1. Temperature:

- a. Both actual ambient temperature test readings and calculated test values, corrected to 20 degrees centigrade (20 degrees C, shall be reported.
- b. Do not test when the insulation temperature is below 0 degrees C.

2. Humidity:

- a. Do not test when the relative humidity is above 70 percent (70%). Deviations to this requirement will be allowed if it can be demonstrated that the higher humidity will not affect the test or that the higher humidity can be accounted for adequately in interpreting the test results.

D. Insulation Resistance (Megger) Test:

1. Subject cables to an insulation resistance test prior to any other tests or energizing.
2. Voltage Source (Megger): capable of providing a constant D.C. voltage for the time intervals as specified below. Hand cranked meggers shall not be used for D.C. voltages greater than 500 volts.
3. Magnitude of Applied D.C. Voltage: depend upon voltage of system to which equipment is connected, as follows:

<u>System Voltage</u>	<u>Test Voltage</u>
150 and under	500
151 to 600	1000
601 and above	2500 (Not required for this project)

4. 2500 Volt Insulation Resistance Tests (Not required for this project): Held a minimum of five (5) minutes, and until three equal consecutive readings one minute apart are obtained. Readings shall be taken and recorded every 30 seconds during the first two minutes, and every minute thereafter.
5. 1000 Volt and 500 Volt Insulation Resistance Tests: held for a minimum of one minute and until the reading reaches a constant value for 15 seconds unless specified otherwise.
6. Apply tests from phase to ground with the other phases grounded. Each phase shall be tested in a similar manner.
7. Phase Matching and Phase Identification: checked immediately prior to energizing of equipment.

E. High Potential Tests (Not required for this project):

1. Cables and Bus Over 600 Volts: Given a high potential D.C. test after splices and stress cones are completed.
2. New Cables: Tested after cables are connected to terminals, to simultaneously test terminations.
3. Proper Safety Precautions: Taken at each point where cable has exposed connections, to prevent personnel from coming in contact with the cable.
4. Insulation Resistance Test: Performed on each cable prior to a high potential test.
5. Test Voltage: Test at 55 KV for new 15 KV class cables; verify with cable and switchgear manufacturer's recommendations; IPCEA standards may be used if manufacturer's recommendations are not available.
6. D.C. Test Potential: Applied in at least eight (8) equal increments until maximum test voltage is reached. Initial application of voltage shall not be greater than rated voltage of cable.
7. D.C. Leakage Current: Recorded at each step after a constant stabilization time consistent with system charging current delay.
8. Graphic Plot: Made of leakage current versus applied potential at each increment.
9. After reaching test voltage, potential shall be maintained for ten minutes. Readings of leakage current shall be recorded every minute.

- a. After ten-minute test, record the decay voltage after one minute, and decay time to 1000 volts.

10. Graphic Plot: Made of leakage current versus time.
11. Conductor Test Potential: Reduced to zero at completion of each conductor test and grounds shall be applied for a minimum of ten (10) minutes.
12. Switches or Other Equipment Connected to a Cable Being Tested: Shall not be subjected to a test voltage in excess of their test rating. In case of conflict, disconnect equipment.
13. Each Conductor: Individually tested with other conductors grounded. Shields shall be grounded.

3.2 TESTING CABLES OVER 600 VOLTS (Not required for this project)

- A. Insulation Resistance Test: performed prior to cable connection.
- B. High Potential Test: performed as specified.
- C. Shield Continuity Test: performed on shielding of shielded cables by measuring D.C. resistance from end to end. Shield shall be checked for ground connection.

3.3 TESTING GROUNDING SYSTEMS

- A. Mechanical Inspection: Grounding system shall be inspected to determine that connections are secure and do not constitute open or high resistance joints. Bolted connections shall be tested with a torque wrench, minimum torque for bolts 3/8-inch diameter and larger shall be 50 ft.-lbs.
- B. Ground resistance: Ground electrode system shall be tested to determine effective resistance to ground.
- C. Equipment ground continuity: Test continuity and bonding to ground of power feeder conduits, equipment enclosures, metallic piping, and equipment ground conductors.

3.4 TEST REPORT

- A. Prepare test report and recommendations and submit to Engineer for review and comment.
- B. Include final version of test report as part of Operation and Maintenance Manual. Final version shall include any information, revisions, or results of additional tests requested by Engineer during initial review.

END OF SECTION 26 08 00

(NO TEXT FOR THIS PAGE)

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS

- A. Equipment specified herein shall be furnished and installed complete by the Contractor.
- B. The equipment specified herein shall meet the applicable of the following agencies and associations.
 - 1. Underwriters Laboratories U.L.
 - 2. National Fire Protection Association, NFPA.
 - 3. National Electrical Manufacturers Association
 - 4. American National Standards Institute, ANSI.
 - 5. Factory Mutual.

1.2 SUBMITTALS

- A. Shop drawings shall be submitted showing KVA, temperature rating, voltage rating, dimensional and other data showing compliance with the electrical and physical requirements of the project.

1.3 Manufacturers

- A. Eaton, Square-D Company (Schneider Electric), Siemens, General Electric
- B. Or approved equal

PART 2 - PRODUCTS

2.1 TYPE AND MOUNTING

- A. All units shall be metal enclosed ventilated dry type for wall or floor mounting as indicated on the plans, or as dictated by physical size.
- B. KVA, voltage and phase ratings shall be as shown on the drawings.
- C. Floor mounted transformers shall be mounted on wire reinforced 3000 psi concrete pads

2.2 ENCLOSURES

- A. Transformer enclosures shall be ventilated type made from minimum 16 gauge steel and shall be designed in such a manner to prevent accidental access to electrically energized parts.

- B. Conduit knockouts shall be provided in-line with the terminals and be of sufficient size and number to accommodate the necessary cables and conduit.

2.3 CORE AND COIL

- A. Core and coil shall be of the highest quality materials to minimize no-load losses and exciting current, and shall be mechanically braced to withstand short circuit stresses of 25 times normal load current for two seconds.
 - 1. Coils may be aluminum or copper. Busbar may be aluminum or copper. Cable lugs shall be rated for both aluminum and copper conductors.
- B. Core and coil assembly shall be internally isolated and shall be subjected to a double dip and bake process.
- C. Coils shall be continuous from start to finish with no splices being allowed. Coils shall have a final wrap of insulating material designed to prevent injury to the magnet wire. Units having visible magnet wire are not acceptable.
- D. Core and coil unit shall be completely isolated from the enclosure by means of vibration absorbing mounts.
- E. Core and coil unit shall be adequately grounded to the enclosure by means of a flexible grounding strap.
 - 1. Provide neutral ground strap and grounding to building structure and ground electrode system.
- F. Terminals for line, load and ground connections shall be supplied. Terminals shall be located in an area of the unit where the temperature does not exceed 40 degrees C . All terminals, lugs, and connectors shall be rated for both aluminum and copper conductors.

2.4 INSULATION AND TEMPERATURE RISE

- A. Insulation and transformer core and coil shall be designed for a maximum 150 degrees C temperature rise above an ambient of 30 degrees C at rated full load.

2.5 TAPS

- A. Units thru 25 KVA shall have two 5% full capacity taps below normal rated primary voltage.
- B. Units 30 KVA and larger shall have two 2-1/2% full capacity above and four 2-1/2% full capacity below normal primary voltage.

2.6 SOUND LEVELS

- A. Sound levels shall not exceed NEMA Standard.

- B. Unless noted otherwise, sound levels shall not exceed 45 db on units thru 150 KVA, 50 db on units from 151 KVA thru 300 KVA and 55 db on units larger than 300 KVA.

2.7 EFFICIENCY

- A. Units shall have a 96% minimum efficiency at 75% load.

2.8 CASE TEMPERATURE

- A. The maximum case temperature at the warmest spot shall not exceed 35 degrees C above a 40 degrees C ambient, regardless of insulation system used.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Transformers shall be installed where shown on the drawings. Units shall be set so as to allow direct access to at least three sides of the unit and NEC minimum or greater space in front of terminations.
- B. Ensure all units have adequate air space for self-cooling.
- C. All hardware and accessories shall be furnished and installed by the Contractor.
- D. Prior to energizing and during start-up, perform electrical tests to provide correct voltages and phase rotation.
- E. Install pad mounted indoor transformers in or adjacent to architecturally finished areas on Korfund (Aeroflex) pads, type "Cork-Rib" style. For ceiling hung transformers, utilize vibration hangars similar to Aeroflex brand series SH/RSH."

END OF SECTION 26 22 00

(NO TEXT FOR THIS PAGE)

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of panelboard, and enclosure work is indicated by drawings and schedules.
- B. Types of panelboards and enclosures in this section include the following:
 - 1. 480V or 277/480V Power-Distribution Panelboards.
 - 2. 120/240V or 120/208V Panelboards.

1.2 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes, including NEC Article 408.30-58, 550.11-12.
- D. UL Compliance: Comply with applicable requirements of Std No. 67, "Electric Panelboards", and Std No.'s 50, 869, 486A, and 1053 pertaining to panelboards, accessories and enclosures. Provide units, which are UL-listed and labeled.
- E. NEMA Compliance: Comply with NEMA Stds. Pub/No, 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)", Pub/No. PB 1, "Panelboards", and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less." Comply with NEMA Pub. No. PB1.2 , "Application Guide for Ground-fault Protective Devices for Equipment", where applicable.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data on panelboards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical panelboard products, which may be incorporated in the work, include the following:

1. Eaton/Cutler-Hammer.
2. Square D Company (Schneider Electric).
3. Siemens.
4. General Electric.
5. Or approved equal

2.2 PANELBOARDS

- A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, copper or aluminum busbars, copper or aluminum full-size neutral bar insulated from ground, copper-only ground bar, and cable lugs rated for both copper/aluminum conductors. Design and construct in accordance with published product information; equip with Main and proper number of Branch overcurrent devices as required for complete installation. Refer to panelboard schedules or one-line drawings.
- B. 277/480V Power Distribution Panelboards: Provide dead-front safety type power distribution panelboards as indicated, with panelboard protective devices in quantities, ratings, types and with arrangement shown. Provide bolt-in main circuit breaker and bolt-in branch circuit breakers for each circuit, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide steel enclosures shall be fabricated by the same manufacturer as panelboard, and shall mate properly with panelboards. Provide NEMA 12, 3R, 4, or 4X enclosures if indicated on the drawings for specific environments.
1. Ratings of panelboards shall have voltage, phase, and ampere ratings as indicated on drawings.
 2. Panelboards shall be UL listed for service entrance where indicated on the drawings.
 3. Panelboards shall be single or of multiple sections as indicated.
 4. Panelboards shall have indicated short circuit rating, or 50,000 AIC rating minimum if not indicated on drawings.
 5. Main circuit breaker shall be bolt-in, molded case, electronic type, with adjustable trip and time delay settings; adjustable short-time pick-up and time delay; adjustable long-time pick-up and time delay.
 6. Short-circuit rating of all circuit breakers shall match or exceed rating of panelboard as indicated on drawings, or not less than 50,000 AIC if not indicated.
 7. Provide bolt-in standard thermal magnetic circuit breakers for branch/feeder circuit breakers unless adjustable type are indicated on the one-line diagram.
 8. Provide GFI protection if indicated, with adjustable set-point and time delay.
 9. Power monitor shall include Ethernet communications to local PLC using Ethernet/IP or Modbus TCP/IP protocol. The power monitor shall be able to collect and transmit data for voltage, current, power consumption to the PLC. Power monitor shall be capable of networking to an Allen Bradley Compact Logix PLC.
- C. Branch Circuit Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance branch circuit panelboards as indicated, with main and branch devices in quantities, ratings, types and arrangement shown with toggle handles that indicate when tripped. All circuit

breakers shall be bolt-in. Where multiple-pole breakers are indicated, provide with common trip so that all poles trip simultaneously. Provide steel enclosures fabricated by the same manufacturer as panelboards, which mate properly with panelboards. Provide NEMA 12, 3R, 4, or 4X enclosures if indicated on the drawings for specific environments.

1. Provide short circuit rating indicated on drawings, but not less than 25,000 AIC if not indicated.
 2. Provide voltage, phase, ampere ratings as indicated on the drawings.
- D. Panelboard Enclosures: Provide galvanized sheet steel cabinet enclosures, in sizes required and NEMA types as indicated, code-gauge, minimum 16-gauge thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps, and doors with flush locks and keys; all panelboard enclosures shall be keyed alike, with concealed door hinges. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed or surface mounting, as applicable. Provide enclosures, which are fabricated by the same manufacturer as the panelboards and which mate properly with the panelboards to be enclosed. Provide NEMA 12, 3R, 4, or 4X enclosures if indicated on the drawings for specific environments.
- E. Provide an Integral Surge Protection device in all panelboards.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS

- A. General: Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standard of Installation", and in compliance with standard recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate installation of panelboards and enclosures with wire and raceway installation work. Coordinate exact locations with other trades to ensure no space conflicts and no transgressions of dedicated panelboard space by piping and ductwork.
- C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A. Where manufacturer's torque requirements are more stringent, manufacturer's requirements shall be followed.
- D. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure. Use unistrut type channels for mounting to exterior walls where moisture contamination may be possible.
- E. Provide properly wired electrical connections within enclosures. Wiring must be neatly routed, with wire management means installed as required for a neat and professional final appearance.

- F. Fill in panelboard's circuit directory card upon completion of installation work. Directory cards shall be typed and 8-1/2" x 11" copies shall be provided as part of the O & M Manual.
- G. Set adjustable circuit breaker trip and time-delay settings where applicable and as indicated by the short-circuit study calculations.

3.2 GROUNDING

- A. Provide equipment grounding connection for panelboards as indicated. All panelboard feeders and branch circuits shall have green insulated equipment ground conductors, or conductors identified with green phasing tape (no. 6 awg and larger). Tighten connections to comply with tightening torques specified in UL Stds 486A, to assure permanent and effective grounds.

3.3 FIELD QUALITY CONTROL

- A. Prior to energizing of circuitry, check tightness of all accessible connections for compliance with manufacturer's tightening torque specifications.
- B. Prior to energizing panelboards, check panelboard busbar and feeder phase-to-phase, and phase-to-ground insulation resistance levels to ensure no ground-faults and no short-circuits exist.
- C. Prior to energizing, check branch circuit panelboards for electrical continuity of circuits, and check for short-circuits and ground-faults.
- D. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate compliance with requirements. Where necessary, correct malfunctions and replace faulty components in the field, and then re-test to demonstrate compliance. Check for proper phase arrangement and rotation; A-B-C left-to-right and top-to-bottom.
- E. Provide "Brady" type numbered wire tags to identify all circuits, identify feeder circuit with color coding, and provide engraved laminate nameplate on panelboard exterior.

END OF SECTION 26 24 16

26 27 16 – ELECTRICAL ENCLOSURES AND CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification covers the technical requirements for the engineering, fabrication, wiring and installation for control panels and enclosures.
- B. The Contractor shall be responsible for adjustments and commissioning of the control panel necessary to place the control panel into service, including proper pump protective device adjustments and programming.
- C. For this project, custom motor control panel, pump control panels, PLC panels, and manufacturer control panels will be fabricated and furnished by the Division 25 Contractor, Pump and Equipment Suppliers. These control panels shall be installed by the Division 26 Contractor per this specification section 26 27 16. Input and output control wiring and power wiring and conduits shall be by the Division 26 Contractor. The Division 25, 26, and Pump and Equipment Suppliers shall work together for testing and commissioning. Refer to Division 25 specification sections and details on the drawings for more information.
- D. For enclosures and control panels not fabricated and furnished by other trades, the Division 26 Contractor shall furnish, fabricate, install, test and commission those enclosures, controls, motor starters, and accessories per this specification section.
- E. The Division 26 Contractor is encouraged to communicate with the General Contractor regarding Scope of Supply and Installation.

1.2 QUALITY ASSURANCE

- A. Equipment specified herein shall meet applicable standards of the following agencies and associations:
 - 1. Underwriters' Laboratories, UL.
 - 2. National Electrical Manufacturers Association, NEMA.
 - 3. National Electrical Code (NEC)
 - a. Wire sizes inside the control panel shall comply with the NEC, for 60° C operation.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The instrument panels and enclosures shall be as follows:
 - 1. Freestanding or rack mounted (Pump Control Panel) outdoor enclosure shall be rated

NEMA 4X, stainless steel, provided with accessories and components as shown on the drawings and detailed in the project specifications.

2. See drawings for additional enclosure type.

- B. Provide conduit accessories as needed for conduits terminating at control panels, including water tight conduit hubs, conduit seals for explosion-proof wiring applications, and manufactured moisture seals for non-hazardous applications. Sealing putty is not acceptable.

2.2 PANEL CONSTRUCTION

A. General

1. Stiffening members shall be provided for strength and stiffness as required.
2. Seamless welded construction shall be used throughout. All exposed seams shall be continuously welded and ground smooth.
3. Lifting rings shall be provided.
4. Sub panels shall be provided as required, with mounting designed for easy removal. The subpanels shall be finished with 2 coats of white enamel paint.
5. Print pockets shall be attached to the interior side of each door.
6. Hinges shall be stainless steel piano continuous hinge type.
7. Provide 3-point door latching mechanisms with handles on front of panel door(s).
8. Provide gasketing if required for rating.

2.3 PANEL GROUNDING

A. Provide an equipment grounding bus bar or terminal block.

1. The ground busbars shall be of nickel-plated copper, rated for 100 amperes.
2. The bus bar shall be provided with two (2) screw clamp terminal blocks, which shall be capable of accepting conductors up to #1 AWG.
3. The bus bar shall be provided with a minimum of twenty (20) screw clamp terminal blocks, which shall be capable of accepting conductors up to #4 AWG.

2.4 PANEL WIRING

- A. Wiring within the enclosure shall be continuous and shall be terminated only at terminal blocks or equipment terminals.
- B. Not more than two wires shall be terminated at any terminal.
- C. Wiring splices and wire nuts will not be permitted within the enclosure.
- D. Wiring within the enclosure shall be protected as follows:
1. In general, all wiring within the enclosure shall be routed in plastic wiring ducts. Wiring ducts shall be sized to include 100% (percent) spare capacity.
 2. Wiring outside of the ducts shall be restrained by means of plastic ties.
 3. Wiring passing a door hinge shall be grouped and wrapped in a protective wire harness.

4. Provide abrasion protection for wire bundles passing through holes or across metal edges.
- E. In general, wiring within the enclosure shall be as follows:
1. Control wiring within the enclosure shall be #14 AWG minimum, stranded, type MTW, 600V.
 2. Wiring for 4-20 mA DC analog signals shall be #18 AWG twisted shielded pair.
 - a. Cables shall meet the following criteria:
 - 1). U.L. Listed Subject 1277
 - 2). Pass IEEE 383 or UL 1581 Flame Test
 - 3). OSHA Acceptable
 - 4). Pass UL VW-1 Flame Test
 - 5). #18 AWG conductors, 7 strand, bare copper
 - 6). 100% aluminum/polyester foil shield
 - 7). 600 volt 90 degrees C rated insulation
 - 8). Each conductor shall be numbered and color-coded.
 - 9). Comply with NEC articles #318, #340 and #501, for power limited tray cable (PLTC)
 - 10). Nominal 2" lay
 - 11). PVC insulation, with ripcord and nylon jacket
 - 12). Suitable for use in wet locations
 - b. The manufacturer of the cables shall be an ISO 9001 certified facility.
- F. In general, wiring within the enclosure shall follow the following color convention to comply with NFPA 79 (1994), part 16:
1. Neutral conductors shall be white.
 2. Line, load and control conductors shall be black.
 3. Grounding conductors shall be green.
 4. Foreign voltage control conductors shall be yellow or orange.
 5. Low voltage (below 50 volts) AC conductors shall be red.
 6. Low voltage neutral (grounded) conductors shall be white with a red stripe.
 7. DC control conductors shall be blue.
 8. DC (+) power conductors shall be blue with a white stripe or purple.
 9. DC (-) (grounded) power conductors shall be white with a blue stripe.
 10. Wiring with multi-conductor cables shall be color-coded.
- Note: Foreign voltage means all control circuits that may remain energized when the main disconnecting means is in the OFF position. Interlocking conductors shall be yellow or orange throughout the entire circuit, including wiring in the control panel and the external field wiring.
- G. AC and DC wiring shall be separated from each other. Where AC and DC wire runs parallel, the minimum separation between them shall be four (4) inches. Where AC and DC wire runs cross, they shall cross at 90 degrees C. Provide separate wiring duct for AC and DC wiring.

- H. Equipment and signal ground wiring, as well as Neutral wiring, shall not be daisy-chained; they shall each be terminated at isolated, bussed terminal blocks.
- I. Each conductor end shall be terminated at a terminal block or at an equipment-wiring terminal. Each terminal block shall have a unique identification number. The terminal blocks shall be arranged and numbered in consecutive order, based on standard alphanumeric order.
- J. Terminal blocks within enclosure shall be grouped as follows:
 - 1. 480 Volts AC power.
 - 2. 120 Volts AC power.
 - 3. 120 Volts AC control wiring.
 - 4. AC isolated Neutral.
 - 5. 24 Volts DC power.
 - 6. 24 Volts DC control wiring for discrete signals
 - 7. 24 Volts DC Common.
 - 8. Analog signal wiring (for 4-20 mA DC signals).
 - 9. Grounding.
- K. Provide 25% spare terminal blocks (minimum of six) for each type used in each enclosure.

2.5 TERMINAL BLOCKS

- A. Except for incoming power terminal blocks, terminal blocks within enclosures shall be of the high-density modular types, constructed of nylon material, suitable for mounting on standard DIN rails. Termination type shall be tubular screw with serrated pressure plate. The terminal block system shall be manufactured by Phoenix Contact, Weidmuller, or equal.
- B. All current carrying parts (metal bodies) shall be made of nickel/tin-plated copper.
- C. Ground terminals shall be color coded in accordance with international standard, which shall be yellow/green.
- D. Matching jumper bridges shall be color coded to the wiring colors.
- E. Panel power distribution fused terminal blocks shall be provided with disconnect lever puller mechanism and illuminated indication.
 - 1. Fused shall be standard $\frac{1}{4}$ " by $1\text{-}\frac{1}{4}$ ", and shall be sized as shown on the drawings.
 - 2. The terminal blocks shall be able to accept up to number 8 AWG conductor.
 - 3. Terminal blocks shall be rated for 15 amps at 250 VAC.
 - 4. Terminal blocks shall be Phoenix Contact type UK 6.3-HESiLA-250, Weidmuller type 6/2, or equal.
- F. Terminal blocks for discrete inputs and outputs shall be two-level types:
 - 1. Both levels shall be of the feed through types.
 - 2. Terminals shall be rated for up to 20 amperes at 300 VAC, and shall be able to accept up

to #12 stranded conductors.

3. Terminal blocks shall be Phoenix Contact type UKKB-3, Weidmuller WDK 2.5, or equal.

G. Terminal blocks for analog inputs and outputs shall be three-level types:

1. The top and center terminations shall be feed through types.
2. The bottom termination shall be grounded through the railing.
3. The terminal blocks shall be rated for up to 10 amperes at 300 VAC, and shall be able to accept up to #12 AWG stranded conductors.
4. The terminal blocks shall be Phoenix Contact type SLKK-5, Weidmuller type DLD 2.5/PE or equal.

H. Terminal blocks for foreign voltage “hot” conductors shall be single level disconnecting type:

1. Blocks shall be orange or yellow to match control wiring per Part 2.04, F.
2. The terminal blocks shall be rated for 10 amperes at 300 VAC, and shall be able to accept #22 thru #12 AWG conductors.
3. The terminal blocks shall be lever type with clear indication of open/close status.
4. The terminal blocks shall be Weidmuller type WRT 2.5, Phoenix Contact or equal.

2.6 PANEL ACCESSORIES

A. Provide (furnish and install) interposing relays to interface all field-mounted equipment with power limited electronic control and communication equipment. Use intrinsically safe relays where field devices are located in hazardous areas.

B. Provide thermostatically controlled heater.

1. Hoffman or approved equal

C. Provide thermostatically controlled ventilation fan, louvers, filters, and screens, designed and manufactured for the application.

1. Hoffman or approved equal

2.7 PANEL INSTRUMENTS

A. Provide all analog signal boosters and isolators necessary to interface all field mounted equipment with control system equipment.

B. Provide audible alarm signaling devices. The device shall be as manufactured by Edwards, Federal Signal, Benjamin, or equal. The unit shall incorporate the following:

1. Flush panel mounting.
2. Weather and vandal resistant
3. Internal gain control for output adjustment (80 dba maximum at 15 feet)
4. UL listed
5. Operating Voltage: 120 VAC

2.8 PILOT AND CONTROL DEVICES

- A. Pilot Devices: Pushbuttons, selector switches, and indicating lights shall be rated heavy-duty, oil-tight or watertight and corrosion resistant as required. All units shall be furnished with standard size legend plates with legends as described on the project Drawings.
- B. Selector switches shall have the number of positions, switching arrangement, number and type of contact blocks indicated on the project Drawings.
- C. Contact blocks shall have a minimum continuous current rating of 10 amperes at 240 VAC. Contact blocks shall have screw type connection terminals.
- D. Indicating lights shall be light emitting diode type 120VAC, color cap, and push-to-test feature. Provide flashing type lights where indicated.
- E. Pilot device manufacturers shall be:
 - 1. Allen-Bradley Bulletin 800H or 800T or equal by same manufacturer as motor starters.
- F. Control relays shall be plug-in type with sockets and hold-in clips. Sockets shall have screw terminals. Contacts shall be silver-cadmium, rated 10 amperes at 240 VAC. Relays shall have two-pole, double throw contacts (DPDT). Relays shall have a manual operator and pilot light. Coil voltages shall be 120 VAC, or as noted on the project Drawings. Relays shall be as manufactured by Allen-Bradley Bulletin 700, Type HA or HB, or equal by same manufacturer as motor starters.

2.9 EQUIPMENT IDENTIFICATION AND WIRE TAGGING

- A. All control wiring shall be identified by means of computer-generated, heat shrink type wire marker. Wire numbers shall be as shown on the drawings.
- B. Each component mounted within the enclosure shall be provided with equipment identification. Equipment and device nameplates or identification shall be of engraved laminated plastic, with white lettering on black background. Nameplates shall be as listed herein or as shown on the project Drawings.

2.10 REGULATED POWER SUPPLY

- A. When DC power supply is required for controllers, and 2-wire analog loops, provide two redundant 24 V DC regulated power supplies.
- B. The contractor shall be responsible for providing and sizing all instrument loop power supplies. The instrument loop power supplies shall be sized to include at least 100% spare capacity. Submit power supply load calculations with the panel shop drawings.
- C. The power supply shall be sized to include 100% spare capacity.

D. Acceptable power supply manufacturers:

1. Phoenix Contact
2. SOLA
3. Or equal

2.11 ACCESSORY CIRCUIT BREAKERS

- A. Accessory circuit breakers shall have terminal lug wire size #14 - #2 AWG Cu or Al. Reversible line and load lugs for flush mount wiring. DIN mounted (symmetrical rail 35 x 7.5 DIN/EN 50 022). UL Listed as HACR type from 15 A to 70 A. Field installable quick connectors. Single handle with internal common trip. UL Listed 120/240VAC (10,000 AIC).
- B. Accessory circuit breakers shall be thermal magnetic type.
- C. Accessory circuit breakers shall be supplied with reversible lugs. Mounting brackets shall be provided for flush installation.

2.12 MOTOR BRANCH CIRCUIT BREAKERS

- A. Motor branch-circuit breakers shall be motor protection type with adjustable instantaneous trip, or thermal magnetic type circuit breakers with inverse time-current characteristics..
- B. Motor branch-circuit breakers shall be provided by manufacturer/supplier of solid-state motor controllers.

2.13 ACCESSORY AND CONTROL POWER TRANSFORMER

- A. Accessory and control power transformer primary shall be as specified on the drawings, dry type, rated 240/480 volt primary, 120 volt secondary, 60HZ, single phase, with two 5% FCBN taps, 115 degrees C temperature rise.
- B. Accessory and control power transformer shall be Acme #TA-2-81220 and TA-2-81323 or equal.

2.14 MOTOR STARTERS, CONTACTORS AND RELAYS

- A. These units shall be type and size with the number of poles and accessories as indicated on the Drawings.
- B. Unless indicated otherwise, all of these units shall be by the same manufacturer as the motor starters.
- C. Control relays shall be plug-in "ice-cube style" with screw terminal base and hold-in clips.
- D. Motor starters shall be Allen Bradley NEMA rated FVNR, or approved equal. IEC motor starters and contactors are not acceptable. Provide thermal overload elements and two sets of NO/NC auxiliary dry contacts. Provide NEMA Size as required or as indicated, but NEMA

size 1 shall be the smallest acceptable size. Provide Hand-Off-Auto selector switch and On pilot light. Provide a fused control power transformer.

- E. Provide enclosure for motor starters and contactors that are not otherwise furnished integral to custom control panels.

2.15 ACCESSORY DEVICES

- A. These devices shall be heavy duty type and shall mount in the starter/pump control panel enclosure on the swing out panel or panel door, as indicated.
- B. Unless otherwise indicated, these devices shall be by the same manufacturer as the motor starters.

2.16 PUMP PANEL ENCLOSURE

- A. Provide stainless steel NEMA 4X enclosure, as indicated on the drawings, with interior painted steel back panel for mounting components, interior painted steel swingout panel for mounting control devices such as control switches and pilot lights, and exterior door with padlock hasp. Non-metallic panels, non-metallic swingout and non-metallic back panels are not acceptable.

2.17 SURGE PROTECTION DEVICE

- A. The SPD shall be constructed using multiple surge current diversion arrays of metal oxide varistors (MOV), matched to 1% variance. The array shall consist of multiple gap-less metal oxide varistors, with each MOV individually fused. The arrays shall be designed and constructed in a manner which ensures MOV surge current sharing. No gas tubes, silicon avalanche diodes or selenium plates/rectifiers shall be used. The status of each array shall be continuously monitored and a green LED shall be illuminated if the array is in full working order. All protection modes, including N-G, shall be monitored and internally fused. Summary alarm dry contacts shall be provided: phase loss, undervoltage, power loss, protection failure.

2.18 PUMPS, MOTORS, and I&C CONTROLS

- A. Refer to Division 25 Specifications and I & C Drawings for Scope of Work.
- B. The Division 26 Contractor shall be responsible for I & C wiring and conduit and connections to instruments.

PART 3 – EXECUTION

3.1 SYSTEM OPERATION

- A. Refer to Division 25, Equipment Specifications, and I & C Drawings and Details.

3.2 INSTALLATION

- A. Provide and install all necessary bracket mounting devices, structural pieces and anchors

necessary for this purpose.

1. Provide a heavy-duty mounting frames, set in concrete. Provide corrosion protection coating for any portion of framez in direct contact with concrete.
- B. General mounting heights for the various type devices shall be as follows, unless otherwise indicated.
1. Control Panel - 5'-6" to top.
- C. All control devices, motor starters, and relays inside the pump control panel shall be identified with engraved laminate nameplate.
- D. Control panels shall have engraved laminate nameplate on exterior.
- E. Install and connect pump cables furnished with each pump.
- F. Install and connect pump seal and temperature sensor cables for each pump motor.
- G. Furnish, install and connect control cables for each level float.
- H. Furnish and install stainless steel strain relief mesh grips and anchors for each cable installed in the wet well as required.

3.3 WIRING

- A. Provide wiring for all motors, starters, VFDs, contactors, control equipment, and instruments.
- B. Connections shown to equipment are approximate and do not represent the actual point of connection. Verify actual location before roughing-in.

3.4 START-UP AND COMMISSIONING

- A. The Manufacturers and Div. 25 and Div. 26 Contractors shall supply authorized personnel for start-up service as needed to ensure satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Owner during the warranty period.
- B. Simulate failures/operations and detail how the operation/failure was simulated with the result. Submit the procedures for simulating the operation/failures to the engineer during the submittal phase. The engineer must approve the means and methods prior to performing the actual test. Include the final test results in the operation and maintenance manual.
- C. The above testing and commissioning may overlap with owner training.

3.5 TRAINING

- A. The Manufacturers and Div. 25 and Div. 26 Contractors shall supply authorized personnel to conduct an Operating and Maintenance training session. The Owner shall have the right to

video tape the training for future reuse.

- B. The training session(s) shall be conducted and repeated as needed until the Owner and Engineer are satisfied that the operators are comfortable with the operation and maintenance of the system. Training shall be done on site with the owner's personnel. Start-up and training personnel shall provide their full attention to this customer while on site.
- C. Contact the Owner at 6 months and 1 year after substantial completion and provide additional training as may be needed to insure all Owner questions related to Operation and Maintenance are addressed.

3.6 WARRANTY

- A. A 1 year warranty shall begin from the time of "substantial completion" as issued by the engineer. This shall cover all materials, parts and labor needed to correct a component failure or workmanship deficiency that becomes known during the warranty period.

END OF SECTION 26 27 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated by drawings. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. GFCI type receptacles.
 - 2. Weatherproof GFCI type receptacles.
 - 3. Toggle switches.
 - 4. Weatherproof toggle switches.
 - 5. Other wiring devices as noted on drawings.
 - 6. Weatherproof 208V simplex receptacles.

1.2 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to installation and wiring devices.
- B. UL Compliance: Comply with applicable requirements of UL 20, "General-Use Snap Switches"; 486A "Wire Connectors and Soldering Lugs for Use with Copper Conductors"; 498, "Electrical Attachment Plugs and Receptacles"; and 943, "Ground Fault Circuit Interrupters" pertaining to installation of wiring devices. Provide wiring devices which are UL-listed and labeled.
- C. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub/ No. WD 1, "General-Purpose Wiring Devices", WD 2, "Semiconductor Dimmers for Incandescent Lamps", and WD 5, "Specific-Purpose Wiring Devices".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering wiring devices which may be incorporated in the work include, but are not limited to, the following:
 - 1. Hubbell Inc.
 - 2. Arrow-Hart
 - 3. Pass & Seymour.
 - 4. Leviton.

5. Eagle.
6. Crouse Hinds
7. Appleton
8. Killark
9. Or approved equal.

2.2 FABRICATED WIRING DEVICES

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub No. WD 1.

2.3 RECEPTACLES

- A. Ground-Fault Circuit Interrupters: Provide "feed-through" type ground-fault circuit interrupters, with heavy-duty duplex receptacles, capable of protecting connected downstream receptacles on single circuit, and of being installed in a 2-3/4" deep outlet box without adapter, grounding type UL-rated Class A, Group 1, rated 20-amperes, 125 volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliampere ground-fault trip level; equip with NEMA 5-20R configuration; side screw wiring terminals. Similar to Hubbell #GF5362.
- B. All receptacles shall be installed with the ground in the DOWN position, if receptacle is oriented vertically.
- C. All receptacles installed outdoors shall be GFCI / Weather-Resistant type with In-Use cover.
- D. Provide stainless steel coverplates for indoor receptacles in NEMA 1 locations.
- E. Avoid locating receptacles in classified areas.
- F. Provide exterior weatherproof 20A, 250V 6-20R simplex receptacles where indicated on the drawings. Provide GFCI type circuit breaker in the source panelboard. Provide in-use cover.

2.4 TOGGLE SWITCHES

- A. Provide 20A 125VAC toggle switches.
- B. Provide stainless steel coverplate for interior switches.
- C. Provide weatherproof in-use covers for outdoor switches.
- D. Provide Class I, Div 1 or Div 2 enclosures and covers, with conduit seal fittings if a toggle switch is located in a classified area.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

- A. Install wiring devices as indicated, in accordance with manufacturer's written instruction, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized

industry practices to fulfill project requirements.

- B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes, which are clean; free from excess building material, dirt, and debris.
- D. Install wiring devices after wiring pull-in work is completed.
- E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A. Use properly scaled torque indicating hand tool.
- F. Devices installed outdoors shall be installed in FD/FS style cast aluminum outlet boxes.
- G. Provide devices rated for the classification as noted on the drawing and properly seal (seal-off) device as required by the NEC.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES

- A. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING

- A. Provide equipment grounding conductor and connection for wiring devices, unless otherwise indicated. Tighten connection to comply with tightening torques specified in US Std 486A to assure permanent and effective grounds. Grounding continuity shall be maintained between devices and metallic raceway system.

3.4 TESTING

- A. Prior to energizing circuitry, test wiring devices for electrical continuity and short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements, by use of a Woodhead or equal continuity testing device.

3.5 IDENTIFICATION

- A. Mark the panelboard name and circuit # to which the device is connected, on each circuit wire, using phenolic tags.

END OF SECTION 26 27 26

(NO TEXT FOR THIS PAGE)

SECTION 26 28 16 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of disconnect switch work and applications are indicated on the drawings.
- B. Applications of disconnect switches include non-fusible equipment disconnects, fusible equipment disconnects, fusible circuit protection, fusible service entrance equipment.
- C. Types of disconnect switches for this project:
 - 1. Heavy duty 480 VAC, 3-pole, fusible or non-fusible as indicated on the drawings, NEMA 4X construction when outdoors.

1.2 QUALITY ASSURANCE

- A. Disconnect switches shall be constructed to NEMA standard KS1-1983; shall be NEMA Type HD; shall be UL listed.

PART 2 - PRODUCTS

2.2 DISCONNECT SWITCHES

- A. All switches shall have switch blades which are fully visible in the "OFF" position when the switch door is open. All current-carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to line-side lugs. Lugs shall be rated for both copper and aluminum conductors and shall be front-removable and UL listed for 75 degrees C conductors.
- B. Switching mechanism shall be quick-make, quick-break, with handle that is pad-lockable in the "OFF" position. The handle position shall indicate whether the switch is "ON" or "OFF".
- C. Enclosure shall be suitable for the environment in which it is installed; or NEMA 4X outdoor weatherproof. Enclosure door shall have door interlock, with defeat mechanism, which prevents the door from opening when the switch is "ON".
- D. Enclosure door shall have door interlock, with defeat mechanism, which prevents the door from opening when the switch is "ON".
- E. All fusible switches shall accept Class R current limiting fuses and shall have rejection clips. UL listed short-circuit rating shall be 200,000 rms symmetrical amperes with Class R fuses.

- F. Ampere rating shall be as indicated on the drawings, or if not indicated as required for the circuit.
- G. Disconnect switches used for service entrances shall be UL listed for service entrance applications and shall have grounding provisions for service grounding and bonding.
- H. Disconnects used for motor safety and located on the load-side of VFDs shall have auxiliary contacts that shall be used to interlock the disconnect switch with the VFD; turn-off the VFD if the disconnect switch is opened.

2.3 MANUFACTURERS

- A. Manufacturers:
 - 1. Eaton/Cutler Hammer.
 - 2. Square D Company (Schneider Electric).
 - 3. Siemens.
 - 4. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install safety switches where indicated on drawings, with ratings indicated.
- B. Install securely to walls, columns, or machine frames, and provide all necessary brackets, anchors, unistrut channels, and hardware.
- C. Do not mount equipment directly to masonry or concrete walls. Provide support channels.
- D. Equip with class RK5 time-delay current limiting fuses if switch is fusible type.
- E. Terminate all conductors including equipment grounding conductor.
- F. Test switch mechanism to ensure smooth mechanical operation.
- G. Test interlock with VFDs.

END OF SECTION 26 28 16

SECTION 26 28 26 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of enclosed circuit breaker work and applications are indicated on the drawings.
- B. Applications of for the project include service entrance equipment.
- C. Types of enclosed circuit breakers for this project:
 - 1. Heavy duty 480 VAC, 3-pole, 50,000 kAIC short circuit rating, NEMA 1 enclosure construction where located indoors, UL listed for service entrance applications or as specified in the drawings.

1.2 QUALITY ASSURANCE

- A. Enclosed switches and circuit breakers shall be UL listed.

PART 2 - PRODUCTS

2.1 ENCLOSED CIRCUIT BREAKERS

- A. All current-carrying parts external to circuit breaker shall be plated to resist corrosion and promote cool operation. Lugs shall be aluminum/copper and shall be front-removable and UL listed for 75 degrees C conductors.
- B. Operating mechanism shall be quick-make, quick-break, with handle that is pad-lockable in the "OFF" position. The handle position shall indicate whether the switch is "ON" or "OFF".
- C. Enclosure shall be suitable for the environment in which it is installed; NEMA 1 indoor; NEMA 4X outdoor.
- D. Enclosure door shall have door interlock, with defeat mechanism, which prevents the door from opening when the circuit breaker is "ON".
- E. Circuit breaker used for the main service disconnect shall be molded-case or insulated-case type, fully adjustable electronic type unless indicated otherwise.
- F. Ampere rating shall be as indicated on the drawings, or if not indicated as required for the circuit.
- G. Enclosed circuit breakers used for service entrances shall be UL listed for service entrance applications and shall have grounding provisions for service grounding and bonding.

2.2 MANUFACTURERS

A. Manufacturers:

1. Eaton/Cutler-Hammer.
2. Square D Company (Schneider Electric).
3. Siemens.
4. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install enclosed circuit breakers where indicated on drawings, with ratings indicated.
- B. Install securely to mounting frame or if floor mount enclosure is provided, bolt to reinforced concrete housekeeping pad. indicated on drawing and provide all necessary brackets, anchors, unistrut channels, and hardware.
- C. Terminate all conductors including equipment grounding conductor.
- D. Test operating mechanism to ensure smooth mechanical operation.
- E. Electrically test for shorts, grounds, and correct connections to determine suitability for energizing.
- F. Adjust trip set-points and time-delays, and affix arc flash hazard labels.
 1. For this project, Engineer will furnish set-points and time-delay chart.
 2. For this project, Engineer will furnish the arc flash labels.

END OF SECTION 26 28 26

SECTION 26 29 23 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Variable-frequency motor controllers (VFD or VSD).

1.2 RELATED WORK

- A. Related work includes pump and motor control panel fabrication and instrumentation and control by other Divisions. For this project, VFDs will be furnished and installed as part of custom motor control panels, provided by the Division 25 Contractor and by Pump/Equipment suppliers. The Division 26 Contractor is encouraged to communicate scope of supply and scope of installation regarding VFDs and related work with the General Contractor. In general, the Division 26 Contractor shall be responsible for installing and wiring VFD Control Panels furnished by others and installing and wiring related instruments furnished by others.

1.3 REFERENCES

- A. NEMA ICS 3.1 – Safety Standards for construction and guide for selection, Installation and Operation of Variable Speed Drive Systems.
- B. NEMA – Enclosures for Electrical Equipment (1000 Volts Maximum).
- C. UL, and CUL Approved
- D. IEEE Standard 444 (ANSI C343)
- E. IEC: 146A

1.4 SUBMITTALS

- A. Shop drawings shall include wiring diagrams, front and side views of enclosures, overall dimensions, conduit entrance locations and requirements, nameplate legends, and enclosure details.
- B. Product Data: Provide data sheets showing voltage, ratings and size of switching and overcurrent protective devices, short circuit ratings, and weights.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of adjustable speed drives.

1.5 QUALITY ASSURANCE

- A. VFD shall have a minimum MTBF (mean time between failure) rating of 28 years.

1.6 OPERATION AND MAINTENANCE DATA

- A. Include instructions for starting and operating VFD and describe operating limits that may result in hazardous or unsafe conditions.

1.7 QUALIFICATIONS

- A. Manufacturer regularly engaged in designing, manufacturing and servicing variable speed drives, with a minimum of five years experience, NEMA and ISO certified.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver store, protect and handle products to site, under provisions of applicable Division 01 Sections.
- B. Accept VFD on site in original packing. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping, or provide an additional heavy canvas or heavy plastic cover, to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully, in accordance with manufacturer’s written instructions to avoid damage to components, enclosure, and finish.

1.9 WARRANTY

- A. Provide VFD warranty, for one year from date of startup. Warranty shall include parts, and labor allowance for repair hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Allen Bradley PowerFlex 755. ABB ACQ580, Square-D ATV630 or approved equal.

2.2 DESCRIPTION

- A. Provide enclosed adjustable speed drives suitable for operating at the current, voltage, and horsepower indicated on the schedule. Conform to requirements of NEMA ICS 3.1.

2.3 RATINGS

- A. The VFD shall be rated to operate from 3-phase power at one of the following voltage ranges. (380-480), VAC +10%/-15%, 48Hz to 63Hz. 5-400 hp the VFD shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 1.0. at all speeds and nominal load. The input power factor shall have programming capability to adjust power factor lagging to leading. The ULH standard VFD efficiency shall be 96.5% or better at full speed and load.
- B. The overvoltage trip level shall be a minimum of 30% over nominal, and the under-voltage trip level shall be a minimum 35% under the nominal voltage.
- C. Normal Duty / Variable Torque output voltage and current ratings shall match the adjustable frequency operating requirements of a standard AC induction, synchronous reluctance (SynRM) or permanent magnet (PM) motors in water and wastewater applications. The short-term normal duty overload current capacity shall be 110% of rated current for one (1) minute out of ten (10) minutes. (See paragraph M below.)
- D. Heavy Duty / Constant Torque output voltage and current ratings shall match the adjustable frequency operating requirements a standard AC induction, synchronous reluctance (SynRM) or permanent magnet (PM) motors in water and wastewater applications. The short-term heavy-duty overload current capacity shall be 150% of rated current for one (1) minute out of ten (10) minutes and peak overload capacity shall be 180% for two (2) seconds out of each minute with an instantaneous overcurrent trip at 350% or higher. Output frequency shall be adjustable between 0Hz and 500Hz forward or reversing. Operation above motor nameplate shall require programming changes to prevent inadvertent high-speed operation.
- E. The VFD shall be furnished in an Open Chassis (IP00), UL Type 1 (NEMA 1) or UL Type 12* (NEMA 12*) listed enclosure rated as specified for operation at ambient temperatures between -15°C and 40°C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed.
- F. The printed circuit boards (PCB) shall be conformal coated to protect from atmospheric contamination by Chemical gasses and Solid particles per IEC 60721-3-3; Chemical gasses Class 3C2 and Solid particles Class 3S2.
- G. VFD must operate without fault or failure, when voltage varies plus or minus 10 percent from rating, and frequency varies plus or minus 5 percent from rating.
- H. Displacement Power Factor: 0.98 over entire range of operating speed and load.
- I. Humidity: non-condensing to 95%.
- J. Altitude: to 3300 feet, higher altitudes achieved by derating.
- K. Starting Torque: 100% starting torque shall be available from 0.5 Hz. to 60 Hz.

- L. Overload capability: 120% of rated F.L.A. (full load amps) for 60 seconds; 180% of rated F.L.A., instantaneously.
- M. The VFD continuous ampere rating shall be 115% of the motor full load amperes; to match the service factor rating of the motor.

2.4 DESIGN

- A. VFD shall employ microprocessor based inverter logic, isolated from all power circuits.
- B. VFD shall include surface mount technology, with conformal coating.
- C. VFD shall employ a PWM (pulse width modulated) inverter system, consisting of:
 - 1. Input Section:
 - a. VFD input power stage shall convert three-phase AC line power into a fixed DC voltage via a solid-state full wave diode rectifier, with MOV (metal oxide varistor) protection.
 - 2. Intermediate Section:
 - a. DC bus as a supply to the VFD Output Section shall maintain a fixed voltage with filtering and short circuit protection.
 - b. DC Bus shall be interfaced with the VFD diagnostic logic circuit, for continuous monitoring and protection of the power components.
 - c. 30hp – 250hp VFDs shall include a DC bus reactor to help minimize reflected harmonics.
 - 3. Output Section
 - a. Insulated gate bipolar transistors (IGBT's) shall convert DC bus voltage to variable frequency and voltage.
 - b. PWM sine coded output to the motor.
- D. The VFD must be selected for operation at carrier frequencies at or above 5KHz without derating to satisfy the conditions for current, voltage, and horsepower as indicated on the equipment schedule. Exception to this requirement is allowed only for VFDs providing 80 amps or more.
- E. VFD shall have an adjustable carrier frequency. The carrier frequency shall have a minimum of six settings to allow adjustment in the field.
- F. VFD shall include two independent remote reference input. One shall be 0-10 VDC. The other shall be programmable for either 0-10 VDC or 4-20 mA. Either input shall respond to a programmable bias and gain.

- G. VFD shall include a minimum of five multi-function-input terminals, capable of being programmed to determine their function when their state is changed. These terminals shall provide up to 30 functions, including, but not limited to:
1. Remote/Local operation selection
 2. Detection of external fault condition
 3. Remote Reset
 4. Multi-step speed commands
 5. Jog Command
- H. VFD shall include a 4-20maDC 24VDC analog output for “speed tracking” the VFD. The 4-20maDC, 24VDC analog output signal will be proportional to output frequency, output current, output power, or DC bus voltage.
- I. VFD shall provide terminals for remote contacts, to allow starting in the automatic mode.
- J. VFD shall include at least one external fault input, which shall be programmable for normally open or normally closed contact.
- K. VFD shall include fully rated form “A” contacts and fully rated form “C” contacts, capable of being programmed to determine what conditions must be met in order for them to change their state. These contacts shall be rated for at least 1A at 250 VAC. Refer to the drawings for intended connections to the Plant Instrumentation and Control System.
- L. VFD shall include a power loss ride through of 2 seconds.
- M. VFD shall include a front mounted, sealed keypad operator, with an English language illuminated LCD display. The operator will provide complete programming, operating, monitoring, and diagnostic capability. Keys provided shall include commands for RUN, STOP, and RESET. Operating mode (auto or manual) and speed setting functions shall be provided.
- N. VFD English display provide readouts of; output frequency in hertz, output voltage in volts, output current in amps, output power in kilowatts, D.C. bus voltage in volts, interface terminals status, and fault codes. All displays shall be viewed in an easy –to-read illuminated LCD with English language as standard.
- O. VFD unit shall include the following meters to estimate use of energy:
1. Elapsed Time Meter
 2. Kilowatt Meter
 3. Kilowatt Hour Meter
- P. VFD shall be capable of PID (Proportional, Integral, and Derivative) logic, to provide closed-loop setpoint control capability, from a remote reference. In addition, energy saving sleep function should be used in conjunction with the PID control.

- Q. VFD shall include loss of input signal protection, with a speed default to 80% of the most recent speed.
- R. VFD shall include electronic thermal overload protection for both the drive and motor. Protection profiles shall be available for variable and constant torque applications.
- S. VFD shall include the following program functions:
1. Critical frequency rejection capability: 2 selectable, adjustable dead-bands.
 2. Auto restart capability: 0 to 10 attempts.
 3. Stall prevention capability.
 4. "S" curve soft start capability.
 5. "Speed search" capability, in order to start a rotating load.
 6. 1 preset and 1 custom volts per hertz pattern.
 7. One fully adjustable volts per hertz pattern.
 8. Current limit adjustment capability, from 30% to 200% of rated full load current of the VFD.
 9. Anti "wind-milling" function capability.
 10. Energy saving PID control with SLEEP function.
 11. Undertorque/Overtorque Detection.
 12. Ability to close fault contact after the completion of all fault restart attempts.
- T. VFD shall include factory settings for all parameters, and the capability for those settings to be reset.
- U. VFD shall include the capability to adjust the following functions, while the VFD is running:
1. Forward/Reverse direction.
 2. Acceleration adjustment from 0 to 3600 seconds.
 3. Deceleration adjustment from 0 to 3600 seconds.
 4. A minimum of six different preset speeds.
 5. Analog output gain, to calibrate the signal for the application used.
- V. VFD shall include NEMA rated by-pass contractor and controls when indicated on drawings.
- 2.5 PRODUCT ACCESSORIES
- A. VFD's not requiring Manual Bypass, a local-remote selector switch will be provided to conveniently switch between "manual" and "auto" modes.
- B. Serial communications gateway, for either RS-232 or RS-485, to provide interface from an VFD to a computer, a Program Logic Controller (PLC), Modbus RTU, or Building Automatic System.
- C. Remote operator station to control and monitor the VFD from remote location.
- D. VFD shall have 3% Line Reactor and 3% Load Reactor.

2.6 FABRICATION

- A. Enclosure: Open type, for installation within a fabricated control panel.
- B. Enclosure shall have ventilation filter, ventilation fan, louvers, and automatic ventilation controls.
- C. Inspect and test, under load, each completed VFD assembly prior to shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surface is suitable for VFD installation.
- B. Do not install VFD until the building environment can be maintained, within the service conditions required by the manufacturer.

3.2 INSTALLATION

- A. Install VFD where indicated, in accordance with manufacture's written instruction and NEMA ICS 3.
- B. Tighten accessible connections and mechanical fasteners after placing VFD.
- C. Provide neatly typed label; on each VFD, identifying nameplate horsepower, full load amperes, model number, service factor and voltage/phrase rating.

3.3 FIELD QUALITY CONTROL

- A. Protect from physical damage, and provide proper alignment, anchorage, and grounding.

3.4 ADJUSTING

- A. Adjust work and calibrate system, to assure proper operation of driven equipment.

END OF SECTION 26 29 23

(NO TEXT FOR THIS PAGE)

SECTION 26 32 13.13 – DIESEL-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Extent of diesel emergency power generator work is indicated by drawings and specification herein, and is hereby defined to include, but not be limited to, Diesel engine, electrical alternator, engine starting system including batteries and charger, instrument control panel, automatic exerciser control, fuel tank, remote emergency shut-off, output contacts and wiring to remote annunciator, engine block heater, critical class exhaust silencer, reach-in outdoor weather-proof enclosure, emergency power system wiring, and all accessories required for a complete installation. The generator shall be designed and rated for standby power/emergency power applications.
- B. Refer to other Division-26 sections for wires/cables, electrical boxes and fittings, panelboards, and wiring devices which are required in conjunction with engine-generator and emergency power system work.
- C. Operational Test and Full Load Test: Conducted after installation to ensure satisfactory operation and compliance with specification.
- D. Operating Instructions: Provided to Owner as specified herein.
- E. Instruction of Personnel: Manufacturer's representative, in cooperation with Contractor, shall instruct Owner's personnel in the operation and maintenance of the plant.
- F. Factory Fabricated Assembly: Complete engine generator set, fuel system, silencer, accessories shall be delivered to the job site fully assembled, factory tested, and ready to be set in place.
- G. Provide a 5 year warranty for the generator and accessories; starting at date of substantial completion.

1.2 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on engine-driven generator set and components, fuel system, transfer switch, and all accessories.
- B. Wiring Diagrams: Submit wiring diagrams for engine-driven generator unit showing connections to control panels, automatic transfer switches, remote indication, and ancillary equipment. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed. Coordinate with contractor for exact wiring requirements of the submitted equipment.

- C. Reinforced concrete housekeeping/mounting pad.

PART 2 PRODUCTS

2.1 DIESEL-ENGINE-DRIVEN GENERATOR SET

- A. Latest commercial design, complete with four-stroke Diesel engine, complete with components and features described in Section 1.01 of this specification.
- B. Manufacturers: Generac, Caterpillar/Olympian, Cummins/Onan, MTE/Detroit Diesel, or Kohler.
- C. Electrical Characteristics:
 - 1. KW – (provide KW rating as indicated on project drawings).
 - 2. Nominal RPM: 1800
 - 3. Power Factor: 0.8
 - 4. Frequency: 60 Hz
 - 5. 277/480 VAC, 3 Phase, 4 Wire, field connectable for different voltages.
 - 6. Maximum Starting Voltage Dip: 30%
 - 7. Maximum Running Surge Voltage Dip: 20%
 - 8. Maximum Frequency Dip: 10%
- D. Engine shall be water cooled with 50% glycol antifreeze coolant, four stroke design with electronic governor, engine safety controls, thermostatically controlled water jacket heater, fuel and oil filters, engine driven fuel pump and oil pump, 12 volt or 24 volt DC starting, charging, and battery system.
- E. Engine instrument panel shall be engine mounted and shall include water temperature gauge, lube oil pressure gauge, running hour meter, voltage and ampere meters, local operating control switches, frequency meter, phase selector switch, rheostat for AC voltage adjustment, interface for remote automatic control via automatic transfer switch, battery system charging/status indicators, and fuel leak detection status. Instrument panel and all integral controls shall be pre-wired and tested at the factory. Provide a fuel quantity gauge either integral to control panel or separately mounted within engine-generator compartment.
 - 1. Per NFPA 37, a remote means of shutting down the engine shall be provided as indicated on the drawings. Provide identification nameplate.
 - 2. Provide a Modbus communication network interface and software drivers for integration of all annunciation and control features on the plant SCADA system.
- F. Manufacturer shall provide input/output terminations and contacts for remote control and annunciation, and shall provide local control and annunciation. Contractor shall provide field wiring from emergency generator to remote annunciator. Coordinate the wiring type required with

the generator manufacturer. The remote annunciator shall be surface wall mounted at location noted on the drawings. Annunciation functions shall include, but not be limited to the following:

1. Run.
 2. Prewarning for low oil pressure.
 3. Prewarning for high coolant temperature.
 4. Low oil pressure shutdown.
 5. High coolant temperature shutdown.
 6. Overcrank shutdown.
 7. Overspeed shutdown.
 8. Switch off/not in automatic start mode.
 9. Low coolant temperature.
 10. High battery voltage.
 11. Low battery voltage.
 12. Normal battery voltage.
 13. Fuel leak detection status.
 14. Unit ON-OFF-AUTO controls.
 15. Low Fuel
- G. Remote Control Capabilities: Arrange controls so that it shall be possible to start-stop the emergency generator and control the position of the automatic transfer switch via the ATS local controls. Control shall be independent of normal power status. It shall be possible to locally lock out remote control for servicing and safety.
- H. Exhaust gas emissions shall meet or exceed all current EPA, IDEM, and local ordinances.
- I. Engine mounted circuit breaker shall be molded case type, three phase, of ampere rating indicated on drawings, metal enclosed, and shall provide manual disconnect, overload protection, and short circuit protection functions.
- J. Cooling system shall be an engine mounted coolant radiator, engine driven fan, and engine driven water pump; fully assembled and filled with 50% glycol coolant at the factory. Cooling system capacity shall be suitable for full load continuous operation at 120 degrees F ambient air temperature. Coolant shall be protected to –30 degrees F. Cooling system shall have an electrically operated jacket heater with thermostat, rated for a 20 Ampere (maximum load of 16 A), 208 V branch circuit, provided with local disconnect switch provided by generator manufacturer, located inside engine-generator enclosure.
- K. Fuel system shall have a sub-base mounted steel tank, with fuel gauge, venting, fill line, engine driven fuel pump, fuel filter, fuel lines, injectors, high and low fuel warning contacts. Entire system shall be factory assembled. Manufacturer's Dealer shall fill with fuel and shall refill after on-site load test so that Owner receives full fuel capacity at time of substantial completion.
1. Fuel tank shall be of double-wall construction and shall have fuel leak detection system.
 2. Provide alarm contact for monitoring leak detection on the plant SCADA system.

3. Fuel system and tank shall comply with all current EPA, IDEM, and local ordinances.
 4. Fuel tank shall have a 2" safety buffer above required fuel capacity fill line; fuel fill line shall end at required fuel capacity line. A .125" fuel drainback orifice shall be required in the fuel fill line at 1" above the required fuel capacity line (to allow drainback of fuel fill line into tank).
 5. Fuel Capacity: Provide fuel capacity for a minimum 24 hours of operation at 100% of generator rated load.
- L. Exhaust system shall include a critical type silencer and stainless steel flexible fittings, exhaust shall be insulated with high temperature filomat fiber blanket and installed completely, including mechanical support, independent of engine. Exhaust silencer and piping size shall be large enough so that engine backpressure limits are not exceeded.
- M. Complete assembly shall mount to a heavy-duty steel skid base, which shall be epoxy anchor bolted to a new reinforced concrete pad. Isolation pads shall be provided between engine/generator and the skid.
- N. Provide a completely assembled and factory finished weather-tight outdoor enclosure. Provide access doors for servicing on both sides. Provide air intake and radiator exhaust louvers.
- O. Housing shall be corrosion resistant, weatherproof, with air intake and exhaust louvers, manufacturer's standard painted finish, with hinged and lockable doors, and air intake and exhaust louvers designed for required flow and silencing. Enclosure shall be sized for reach-in operation and servicing.
- P. Batteries and Charger:
1. Emergency generator manufacturer shall furnish and install Lead Acid type batteries for engine starting. Size for three consecutive starting attempts of ten seconds duration each, minimum, at low temperature.
 2. Emergency generator manufacturer shall furnish and install automatic battery charger for Lead Acid batteries; solid state, regulated output and alarm output. Locate battery charger inside the engine enclosure and provide with cord and plug set.
 3. Provide a battery heater with integral thermostat and cord and plug set.
 4. Electrical contractor shall provide two 20A, 120V, GFI duplex receptacles with in-use weather covers, inside the enclosure for the above plug-in items. Provide two separate 20A, 120V circuits.
- Q. Generator shall have a Network Card, protocol converters, accessories, etc. to make generator capable of networking with Allen Bradley Compact Logix PLC or as specified on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Contractor shall install engine generator system in accordance with approved shop drawings and

manufacturer's instructions. Coordinate with all trades with regard to scheduling of work. Protect from damage during remaining construction activities.

- B. Provide steel reinforced concrete housekeeping pad with crushed stone or pea gravel base, designed for the actual generator furnished. Submit shop drawings of the housekeeping pad.

3.2 START-UP AND OPERATIONAL TEST

- A. Furnish all fluids (by Manufacturer's Dealer) not factory installed, including fuel.
- B. Check out of final installation, connections and start-up shall be performed by factory authorized technical personnel.
- C. Load bank test shall be performed by manufacturer's dealer, as scheduled below. Operating parameters recorded and submitted to Engineer for approval. Factory technicians shall submit statement of acceptance before final acceptance by Engineer and Owner.

1. Load Bank Testing Schedule:

- a. 25% for 30 min.
- b. 50% for 30 min.
- c. 75% for 30 min.
- d. 100% for 1 hour

- 2. Demonstrate that all accessories are operating properly.
- 3. Demonstrate that automatic transfer switch is functioning properly.
- 4. Schedule start-up, check out and testing a minimum of 7 days in advance with Owner/Engineer.
- 5. Demonstrate that all remote indication and remote control features are functioning properly.
- 6. Refill fuel to capacity after completion of testing.

- D. Conduct Owner training (by manufacturer's dealer). Provide 4 hours of training for Owner's personnel.
- E. Submit as-built record drawings and specifications, and submit Operation and Maintenance Manuals to Engineer for approval and forwarding to Owner (both Contractor and manufacturer).

END OF SECTION 26 32 13.13

(NO TEXT FOR THIS PAGE)

SECTION 26 36 23 - AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SCOPE

- A. Furnish and install automatic transfer switch with number of poles, amperage, voltage, withstand, and current ratings as shown on the plans. Each automatic transfer switch shall consist of a double throw power transfer switch mechanism, and a micro-processor controller to provide automatic operation.
- B. For this project, ATS shall use open transition switching scheme with program delayed neutral position. Normal and Emergency circuits should not be paralleled. The transfer switch shall “stop in the middle position” for an adjustable time period to allow all motors to stop and all VFDs to deenergize before completing the transfer/retransfer. This feature shall apply to transfers to the generator and retransfer to the utility source, including during testing/exercising.
- C. ATS shall have solid neutral.
- D. Provide a 5 year warranty for the Automatic Transfer Switch and accessories.

1.2 CODES AND STANDARDS

- A. The automatic transfer switches, controls and accessories shall conform to the requirements of:
 - 1. UL1008 - Standard for Automatic Transfer Switches
 - 2. NFPA 70 - National Electrical Code
 - 3. NFPA 99 - Essential Electrical Systems for Health Care Facilities
 - 4. NFPA 110 - Emergency and Standby Power Systems
 - 5. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - 6. NEMA Standard ICS10 (formerly ICS2-447) - AC Automatic Transfer Switches

1.3 ACCEPTABLE MANUFACTURERS

- A. Automatic transfer switches shall be ASCO 7000 Series.

PART 2 - PRODUCTS

2.1 MECHANICALLY HELD TRANSFER SWITCH

- A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a solenoid mechanism, momentarily energized.

- B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.
- D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual-operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel, for inspection and service, when required.
- E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

2.2 MICROPROCESSOR CONTROL PANEL

- A. The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and serial communications capability. The control panel shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the control panel to be disconnected from the transfer switch for routine maintenance.
- B. The control panel shall be completely enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.
- C. The control panel shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1. IEEE472 (ANSI C37.90A) Ring wave test.
 - 2. EN55011: 1991 Group 1, Class A Conducted and radiated emission.
 - 3. ISC1000-4-2 (EN61000-4-2): 1995 Electrostatic discharge (ESD) immunity.
 - 4. IEC1000-4-3 (ENV50140): 1993 Radiated electromagnetic field immunity.
 - 5. IEC1000-4-4 (EN61000-4-4): 1995 Electrical fast transient (EFT) immunity.
 - 6. IEC1000-4-5 (EN61000-4-5): 1995 Surge transient immunity.
 - 7. ENV50141: 1993 Conducted radio-frequency field immunity.
 - 8. EN61000-4-11: 1994 voltage dips, interruptions and variations immunity.
 - 9. Mil Std 461, Class 3C, Group 1 Test UM05 Radiated and conducted electromagnetic emissions.

2.3 ENCLOSURE

- A. Automatic transfer switches located outdoors shall be furnished as specified on drawings or

otherwise in a NEMA 4X, stainless steel enclosure, including a strip heater with thermostat. Indoor units shall be furnished in a NEMA 1 steel enclosure unless otherwise shown on the plans.

- B. Controller shall have a flush-mounted display with LED indicators for switch position and source availability. It shall also include test and time delay bypass switches.

2.4 VOLTAGE AND FREQUENCY SENSING

- A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 90% to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting for open transition operation.
- B. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage set at 90% of nominal and independent frequency sensing with pickup set at 95% of nominal for open transition operation.
- C. Repetitive accuracy of all settings shall be within +/- 2% over an operating temperature range of -20 deg. C. to 70 deg. C.
- D. Voltage and frequency settings shall be field adjustable without the use of tools, meters or power supplies. Actual settings shall be clearly defined in the operator's manual.
- E. Provide in-phase closed transition transfer and retransfer and active generator control.

2.5 TIME DELAYS

- A. A time-delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals; adjustable for either 1 or 3 seconds.
- B. A time-delay shall be provided on retransfer to normal, adjustable from 1 second to 30 minutes. Time-delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
- C. A time-delay shall be provided for shutdown control of the engine generator, to allow for engine cool down, without load, and shall be set at 5 minutes.
- D. All adjustable time delays shall be fully adjustable without the use of tools.
- E. Adjustable time delays shall be provided for "programmed neutral" hold position during transfers and retransfers.

2.6 ADDITIONAL FEATURES

- A. A SPST gold-flashed contact rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry-cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred; additionally, provide a "commit/no commit

to transfer” selector switch to select whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

- B. A momentary-type test switch shall be provided to simulate a normal source failure.
- C. Terminals shall be provided for a remote contact, which opens to signal the ATS to transfer to emergency, and for remote contacts, which open to inhibit transfer to emergency and/or retransfer to normal.
- D. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.
- E. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.
- F. Auxiliary contacts, rated 0.5 amps, 125 VAC, shall be provided to indicate the actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
- G. Engine Exerciser – A programmable engine generator exercising timer shall be provided for weekly or biweekly operation, including a selector switch to select exercise with or without load transfer. The exercise period shall be selectable by day of the week, with the starting time by day adjustable in 1 minute increments. The run time shall be adjustable for 1 minute to 24 hours per day in 1 minute increments, factory set at 30 minutes. A Daylight Savings Time adjustment shall also be included, factory set at Not Enabled.
- H. Electric strip heater with thermostat, 120 VAC, for exterior units.

2.7 WITHSTAND AND CLOSING RATINGS

- A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.
- B. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1 1/2 and 3 cycle, long-time ratings.
- C. For this project, provide 50,000 RMS Sym. Amperes rating minimum.

2.8 TEST AND CERTIFICATION

- A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- B. The transfer switch and control panel shall be subjected to a dielectric strength test per NEMA

Standard ICSI-109.21.

2.9 SERVICE REPRESENTATION

- A. The ATS manufacturer shall maintain a national service organization. The service personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
- B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install automatic transfer switches in accordance with approved shop drawings and manufacturer's instructions. Coordinate with all trades with regard to scheduling of work. Protect unit from damage during remaining construction activities. Use unistrut type channels for mounting to walls.

3.2 START-UP AND OPERATIONAL TEST

- A. Check-out of final installation, connections and start-up shall be performed by factory authorized technical personnel.
- B. Conduct 4 hours of Owner training and demonstration of operation by manufacturer's representative. Include demonstration of remote control operation. Demonstrate all functions of interface with emergency power system.
- C. Submit As-Built record drawings and specifications, and submit Operation and Maintenance Manuals to Engineer/Architect for approval and forwarding to Owner.

END OF SECTION 26 36 23

(NO TEXT FOR THIS PAGE)

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of all trades apply to work of this section. Communicate with the other trades regarding final locations of exterior lighting fixtures with equipment locations, walkways, drives, etc.
- B. Division - 26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

- A. Extent of exterior lighting fixture work is indicated by drawings and schedules.
- B. Types of exterior lighting fixtures in this section include the following:
 - 1. LED, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions on each type exterior building lighting fixture.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of exterior building lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with exterior lighting fixture work similar to that required for project.
- C. Codes and Standards:
 - 1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 225, 250, 410, and 501 as applicable to installation and construction of exterior building lighting fixtures.
 - 2. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Pub/No. LE 2 pertaining to lighting equipment.
 - 3. UL compliance: Comply with requirements of UL standards, including Stds. 486A and B, pertaining to exterior lighting fixtures. Provide exterior lighting fixtures and components which are UL-listed and labeled.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver exterior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from construction debris and physical damage.
- B. Store exterior lighting fixtures in original wrappings in a clean dry space. Protect from weather, dirt, fumes, water, construction debris and damage.
- C. Handle exterior lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; remove units from site and replace with new.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of exterior lighting fixtures with other work.
- B. Sequence exterior lighting installation with other work to reduce possibility of damage and soiling of fixtures during remainder of construction period.

1.7 MAINTENANCE

- A. Maintenance Data: Submit maintenance data and parts list for each exterior lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include that data, product data, and shop drawings in a maintenance manual; in accordance with requirements of division 1.
- B. Extra Stock: Furnish stock or replacement lamps amounting to 10 percent (but not less than one lamp in each case) of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Owner's storage space.

1.8 WARRANTY

- A. For LED fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are listed on the fixture schedule.

2.2 EXTERIOR LIGHTING FIXTURES

- A. General: provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, poles, drivers, energy efficient ballasts, starters, lamps and wiring.

- B. Wiring: Provide electrical wiring within fixtures which is suitable for connection to branch circuit wiring as follows:
1. NEC Type AF for 120-volts, minimum no. 18 AWG.; NEC Type SF-2 for 208-volts or 277-volts, minimum No. 18 AWG.
- C. High-Intensity-Discharge Lamp Ballasts (Not used for this Project): Provide HID lamp ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly mates and matches lamps to electrical supply by providing appropriate voltages and impedances for which lamps are designed. Design ballasts to operate lamp within the lamp's power trapezoid requirements. Ballasts shall be high power factor type and primary shall be fused.
- D. Lamps: Provide clear metal halide in wattage indicated (Not used for this Project).
- E. Fusing: Provide Primary Fusing in all phase conductors.
- F. Poles: Poles for LED luminaires shall be aluminum or as indicated on the drawings with factory finish. Aluminum poles shall be factory wrapped with heavy weatherproof paper for protection during handling and shipping.
- G. LED Drivers: Luminaires shall be equipped with an LED driver(s) that accepts the voltage as indicated on the "Luminaire (Lighting Fixture) Schedule". Individual driver(s) shall be replaceable. Drivers shall comply with the following requirements:
1. Drivers shall be UL 8750 class 2 listed for their intended purpose.
 2. Drivers shall have a minimum efficiency of 85%
 3. Drivers shall reliably start at minimum ambient temperatures from -40°C with to 40°C with THD of <=20%.
 4. Drivers shall deliver full-range from 0-10V control signal (not used).
 5. Provide 120VAC drivers.
- H. LED Light Source (Light engine): All Led light engines shall be set to achieve IES, Type III, Type IV or Type V distribution as shown on the "Luminaire (Lighting Fixture) Schedule". Individual light engines shall be replaceable. LED Light sources shall comply the following conditions: requirements:
1. LED light engines shall have a minimum lifetime of 50,000+ hours at 40°C and shall have a minimum efficacy of 80 lumens per watt.
 2. All LEDs shall be installed with 0 lumens above 90° up from nadir (full cut-off) performance.
 3. LED dies shall be tested in accordance with I.E.S.N.A. LM-80-08 standards.
- I. Dimming Controls: Dimming controls shall be compatible with the lighting control system (Not used).

2.3 PHOTOCCELL CONTROLLERS

- A. 2000 watt, 120 VAC rated, conduit pedestal mounted, used to control an individual circuit or a lighting contactor; Tork Model #2101 or approved equal.
- B. Provide a programmable 7-day time clock/time switch.
- C. Provide an H-O-A selector switch.
- D. Provide panel enclosed control system.
- E. Design controls to provide "ON" signal at dusk, and "Off" signal at Dawn or at a pre-determined time by the Time Clock.
- F. In the Hand position, all fixtures shall be "On" for maintenance check.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate which will support lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF EXTERIOR LIGHTING FIXTURES

- A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry requirements.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.
- C. Fasten lighting fixtures and brackets securely to structural supports and ensure that installed fixtures are plumb and level.
- D. For grade level area fixtures construct reinforced concrete bases flush with grade, with conduits, anchor bolts and ground wire. Provide six-foot minimum ground rod located six foot distant from pole, 24" below finished grade to top of ground rod; provide #4 ground wire.
- E. Install poles on bases and adjust to provide plumb installation.

3.3 GROUNDING

- A. Provide equipment grounding connections for exterior lighting fixtures. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective

grounds.

3.4 FIELD QUALITY CONTROL

- A. At the Date of Substantial Completion, replace lamps in exterior lighting fixtures which are observed to be noticeably dimmed as judged by the Architect/Engineer.

3.5 ADJUSTING AND CLEANING

- A. Aim adjustable lighting fixtures and lamps in night test of system.
- B. Clean lighting fixtures of dirt and debris upon completion of installation.
- C. Protect installed fixtures from damage during construction period.

3.6 DEMONSTRATION

- A. Upon completion of installation of exterior lighting fixtures, and associated electrical supply circuitry, apply electrical energy to circuitry to demonstrate compliance with requirements. Where possible correct any malfunctions at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 26 56 00

(NO TEXT FOR THIS PAGE)

SECTION 26 90 00 - ELECTRICAL HEAT TRACE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Self-regulating cables.
 - 2. Heat-tracing controls.

1.2 DEFINITIONS

- A. Self-Regulating Index (SRI): The rate of change of power output in Watts per degree F, as measured between the temperatures of 50- and 100-degrees F.

1.3 REFERENCE STANDARDS

- A. ASTM International:
 - 1. ASTM B193 - Standard Test Method for Resistivity of Electrical Conductor Materials.
 - 2. ASTM D2633 - Standard Test Methods for Thermoplastic Insulations and Jackets for Wire and Cable.
- B. FM Global:
 - 1. FM Approval Guide.
- C. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NFPA:
 - 1. NFPA 70 - National Electrical Code (NEC).

1.4 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information for system materials and component equipment, including thermal properties, electrical characteristics, and connection requirements.
- C. Shop Drawings:
 - 1. Indicate system materials and component equipment.
 - 2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
- G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- H. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.
- I. Qualifications Statement:
 - 1. Submit qualifications for manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping and appurtenances receiving heat tracing, and locations of source power and controls.

1.7 QUALITY ASSURANCE

- A. Perform Work according to manufacturer's standards.
- B. Maintain one copy of each standard affecting Work of this Section on Site.
- C. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

D. Regulatory Requirements:

1. National Electrical Code: Components and installation shall comply with NFPA 70.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

- A. Field Measurements:
1. Verify field measurements prior to fabrication.
 2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five-year manufacturer's warranty for heat tracing and components.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Design Requirements: Provide pipe tracing cable system capable of maintaining pipe contents at temperature of 40°F when outside ambient temperature is 20°F with 20 mph wind.

2.2 MANUFACTURERS

- A. Chemelex, Division of Raychem Corporation.
- B. Delta-Therm Corporation
- C. Or Approved Equal.

2.3 CABLE DESIGN

- A. Voltage: 120v, 60 Hz, 1 ph as shown on Drawings for electrical connection.
- B. Parallel design, current flow across cable.
- C. Heat output/ft constant, independent of length.
- D. Capable of overlapping without creation of hot spots.
- E. Cut to any length in field.
- F. Self-regulating heat output.
- G. Braided metallic shield.
- H. Outer plastic jacket.
- I. Provide manufacturers standard power connections, end seals, splice and tee kit components.
- J. Provide lighted end seal on each individual heat trace line.
- K. Provide proper fittings and appurtenances for field connection of system to conduit and wiring without need for procurement of special fittings or wiring devices.
- L. Provide Hazardous Rated Equipment as Required. See Drawings for Hazardous Location Requirements.

2.4 SOLID STATE HEAT TRACE CONTROL AND MONITORING SYSTEM

- A. Control and Monitoring System
 - 1. Programmable keypad with password lockout feature to prevent unauthorized programming changes.
 - 2. Memory: Nonvolatile, restored after power loss.
 - 3. Temperature: °F or °C.
 - 4. Operating ambient temperature: -40°F to +140°F
- B. Stored parameters:

1. Minimum and maximum temperature.
 2. Maximum ground fault current.
 3. Maximum heater current.
 4. Power accumulator.
 5. Relay cycle count.
 6. Time in use.
- C. Solid state relays with proportional control and have the ability to monitor the following
1. Current.
 2. Resistance.
 3. Temperature.
 4. Voltage.
 5. Ground Fault: 30ma trip level and 20ma alarm level.
 6. Dedicated solid state relay for each heat trace line
- D. Alarm conditions:
1. Low/high temperature.
 2. Low/high current.
 3. Low/high voltage.
 4. Low/high resistance.
 5. Ground fault alarm and trip.
 6. RTD failure.
 7. Loss of programmed values.
 8. Solid state relay failure.
- E. Digital display with the following:
1. Actual temperature.
 2. Control temperature.
 3. Heat trace current.
 4. Heat trace voltage.
 5. Heat trace resistance.
 6. Heat trace ground faults.
 7. Programming parameter values.
 8. Alarm values.
- F. LED status lights:
1. Current mode.
 2. Heater on.
 3. Alarm condition.
 4. Receive/transmit data.
- G. Automatic diagnostic cycle to check heat trace lines for faults.

2.5 Thermostatic sensing control:

- A. Provide ambient sensing thermostat to operate pipe heating systems when ambient temperature drops to 40°F.
- B. Provide alarm thermostat on each heat trace line to monitor pipe temperature. Initiate alarm when pipe drops below 35°F.
- C. Enclosure:
 - 1. Viewing window on enclosure front for observing digital display of controller.
 - 2. Padlockable enclosure.
 - 3. NEMA 4X Stainless Steel.
- D. Communications:
 - 1. Provide interface hardware and software to operate from standard PC. The PC shall have the ability to monitor and program each heat trace control and monitoring unit.
 - 2. Cable: Shielded twisted pair, daisy chained to heat trace control and monitoring units.
 - 3. Each heat trace control and monitoring unit shall have a unique address.

2.6 Thermostatic sensing control:

- A. Provide ambient sensing thermostat to operate pipe heating systems when ambient temperature drops to 40°F.
- B. Provide alarm thermostat on each heat trace line to monitor pipe temperature. Initiate alarm when pipe drops below 35°F.
- C. Enclosure:
 - 1. Viewing window on enclosure front for observing digital display of controller.
 - 2. Padlockable enclosure.
 - 3. NEMA 4X Stainless Steel.
- D. Communications:
 - 1. Provide interface hardware and software to operate from standard PC. The PC shall have the ability to monitor and program each heat trace control and monitoring unit.
 - 2. Cable: Shielded twisted pair, daisy chained to heat trace control and monitoring units.
 - 3. Each heat trace control and monitoring unit shall have a unique address.

2.7 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Testing:

1. Retain at least 75 percent of rated power after 20 years of operation at maximum published continuous exposure temperature.
 2. Retain at least 90 percent of rated power after 1,000 hours of operation at maximum published intermittent exposure temperature.
 3. Cable Dielectric Test: Passing 2.5 kV dielectric test for one minute according to ASTM D2633 after undergoing a 0.5 kg-m impact.
 4. Before shipment, demonstrate cable insulation resistance of 20 megohms minimum bus to braid using a 2,500-V dc megger, and demonstrate tolerance for one minute at voltage equal to twice rated plus 1,000 V applied bus to braid.
 5. Thermal Runaway:
 - a. Ensure that cable produces less than 0.5 W/ft. when energized and heated to 350 degrees F for 30 minutes.
 - b. After testing and reenergizing, demonstrate that cable does not have an increasing power output leading to thermal runaway.
- C. Owner Inspection:
1. Make completed heat-tracing assembly available for inspection at manufacturer's factory prior to packaging for shipment.
 2. Notify Owner at least seven days before inspection is allowed.
- D. Owner Witnessing:
1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
 2. Notify Owner at least seven days before inspections and tests are scheduled.
- E. Certificate of Compliance:
1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
 2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that surfaces of pipes, valves, and fittings are clean and dry.
- C. Verify that piping has been inspected and is ready for insulation.

3.2 INSTALLATION

- A. Install heat tracing before insulation is installed.
- B. Install equipment according to manufacturer instructions.
- C. If required, spiral heat-trace cable around piping to obtain proper heating per length of piping.
- D. Do not overlay cable over cable.
- E. Cover installed heating cable with thermal insulation and waterproof jacketing as soon as possible.
- F. Affix following label to exterior of thermal insulation every 15 feet and readily visible from ground level: CAUTION: ELECTRIC HEAT TRACING.

3.3 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. After installation, inspect for proper operation.
- C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than five days on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.
- D. Equipment Acceptance:
 - 1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
 - 2. Make final adjustments to equipment under direction of manufacturer's representative.
- E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 ADJUSTING

- A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Check control functions and adjust as required.

3.5 DEMONSTRATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 26 90 00

(NO TEXT FOR THIS PAGE)

SECTION 31 23 16.13 - TRENCHING

PART 1 - GENERAL

- A. Excavate subsoil required for utilities..
- B. Remove lumped subsoil, boulders, and rock.
- C. Perform excavation in accordance with utility's requirements.
- D. Do not advance open trench more than 100 feet ahead of installed pipe.
- E. Cut trenches sufficiently wide, within established construction limits and/or temporary construction easements, to enable installation and allow inspection. Remove water or materials that interfere with work.
- F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.
- G. Excavate trenches to depth indicated on drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
- H. Do not interfere with 45 degree bearing slay of foundations.
- I. When project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by engineer until suitable material is encountered.
- J. Cut out soft areas of subgrade not capable of compaction in place. Backfill with subsoil fill and compact to density equal to or greater than requirements for subsequent backfill material.
- K. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by engineer.
- M. Remove excess subsoil not intended for reuse, from site.
- N. Provide means of ingress and egress from the trenches as required by applicable safety and health regulations.

(NO TEXT FOR THIS PAGE)

SECTION 31 23 23 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil fill materials.
2. Coarse aggregate materials.
3. Fine aggregate materials.
4. Backfilling site structures to subgrade elevations.
5. Fill for over-excavation.

B. Related Sections:

1. Section 31 23 16.13 - Trenching.

1.2 REFERENCES

A. Indiana Department of Transportation (INDOT) Standard Specifications (latest edition).

B. ASTM International:

1. ASTM D698 - Standard Test Method for Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (shallow depth).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Materials Source: Submit name of imported fill materials suppliers.

C. Material Data: Submit gradation charts, sieve analysis for imported aggregate testing results.

D. Test Reports: Submit certified laboratory reports of all proposed backfill material. Test reports are to be dated within 6 months of backfill operation.

1.4 QUALITY ASSURANCE

- A. Furnish each imported material from single source throughout the Work.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Subsoil Fill: Excavated and reused material; graded and free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- B. Structural Fill: Coarse aggregate #8 aggregate conforming to INDOT Standard Specifications.
- C. Granular Fill: B-borrow sand conforming to INDOT Standard Specifications.
- D. Select Fill: No. 53 aggregate conforming to INDOT Standard Specifications.
- E. Concrete Fill: Concrete used for fill around utility piping shall have a compressive strength of 3,000 psi concrete.
- F. Frozen Materials: Do not use frozen material for filling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify subdrainage, damp proofing, or waterproofing installation has been inspected.
- B. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 STOCKPILING

- A. Stockpile materials on site at locations approved by Owner.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion and deterioration of materials.
- E. Stockpile Cleanup: Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.3 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with subsoil fill and compact to density equal to or greater than requirements for subsequent fill material.

3.4 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact in accordance with INDOT standards.
- D. Employ placement method that does not disturb or damage other work.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Make gradual grade changes. Blend slope into level areas.
- G. Remove surplus backfill materials from site.
- H. Leave fill material stockpile areas free of excess fill materials.

3.5 TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 0.5 inch from required elevations.
- C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Perform laboratory material tests in accordance with ASTM D698.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D6938.
 - 2. Moisture Tests: ASTM D1557.

- D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- E. Proof roll compacted fill surfaces under slabs-on-grade and paving.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01 73 00 - Execution.
- B. Section 01 77 00 – Closeout Procedures.
- C. Reshape and re-compact fills subjected to vehicular traffic.

3.8 SCHEDULE

- A. Fill to Correct Over-excavation:
 - 1. Select fill, flush to required elevation, compact uniformly to 95 percent of maximum density.

3.9 COMPACTION EQUIPMENT

- A. Equipment and Methods: Carry out all compaction with suitable approved equipment and methods.
 - 1. Compact clay and other cohesive material with sheep's-foot rollers or similar equipment where practicable. Use handheld pneumatic tampers elsewhere for compaction of cohesive fill material.
 - 2. Compact low cohesive soils with pneumatic-tire rollers or large vibratory equipment where practicable. Use small vibratory equipment elsewhere for compaction of cohesionless fill material.
 - 3. Do not use heavy compaction equipment over pipelines or other structures unless the depth of fill is sufficient to adequately distribute the load.

3.10 FINISH GRADING

- A. Final Contours: Perform finish grading and blend into conformation with remaining natural ground surfaces.
 - 1. Leave all finished grading surfaces smooth and firm to drain.
 - 2. Bring finish grades to elevations within plus or minus 0.10 foot of existing or contours shown.
- B. Surface Drainage: Perform grading outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish

grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water

3.11 RESPONSIBILITY FOR AFTERSSETTLEMENT

- A. Aftersettlement Responsibility: Take responsibility for correcting any depression which may develop in backfilled areas from settlement within one year after the work is fully completed. Provide as needed, backfill material, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and lawn replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved.

3.12 INSPECTION AND TESTING OF FILLING

- A. Sampling and Testing: Engage an independent testing laboratory to perform all sampling, testing, and laboratory analysis in accordance with the appropriate ASTM Standard Specification. Provide compaction testing of all in-place backfill after every 400 feet of pipe installation. Record in-place fill compaction values at 50-foot intervals. Additionally, record compaction values at a minimum of 10 feet and 5 feet below final surface elevation and at the surface at each location. Record in-place fill compaction values at a minimum of 10 feet and 5 feet below final surface elevation and at the surface at all road/driveway crossings. Record in-place fill compaction values a minimum of 10 feet and 5 feet below final surface elevation and at the surface at 25-foot intervals through roadway/parking areas. Submit copies of all fill tests to the Engineer. If testing reveals non-compliance with Contract requirements, all additional testing and placement of adequately compacted fill will be made at the Contractor's expense.
- B. Correction of Work: Correct any areas of unsatisfactory compaction by removal and replacement, or by scarifying, aerating, or sprinkling as needed and recompaction in place prior to placement of a new lift.

END OF SECTION 31 23 23

(NO TEXT FOR THIS PAGE)

SECTION 31 25 00 – EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The following Sections and general provisions apply to this Section.
 - 1. 31 25 00 "Site Clearing".
 - 2. 31 23 16 "Excavation".
 - 3. 31 23 23 "Fill".

1.2 SUMMARY

- A. Section includes Temporary control measures as shown on the plans or as ordered by the Owner during the life of the Contract to control water pollution, soil, erosion, and siltation using berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

1.3 DESCRIPTION

- A. This item shall consist of temporary control measures as shown on the Drawings or as ordered by the Owner during the life of the Contract to control water pollution, soil erosion, and siltation using berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.
- B. Temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this Contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.
- C. Temporary control may include work outside the construction limits such as borrow pit operations, equipment, and material storage sites, waste areas, and temporary plant sites.

1.4 SUBMITTALS

- A. Submit Erosion Control Plan Product Cut Sheets to Engineer for review and approval.

- B. Prior to start of construction, Contractor shall submit schedules for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, and construction. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operations for the applicable construction have been accepted by the Engineer.

PART 2 - PRODUCTS

2.1 MULCHES

- A. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials.
- B.

2.2 STRAW BALE DIKE

- A. Straw bale dikes shall be used as needed to prevent soil erosion at all stream or ditch crossings.

2.3 OTHER

- A. All other materials shall meet commercial grade standards and shall be approved by the engineer before being incorporated into the project.

PART 3 - EXECUTION

3.1 GENERAL

- A. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.
- B. The Contractor shall be responsible for compliance to the extent that construction practices, construction operations, and construction work are involved.

3.2 AUTHORITY OF OWNER

- A. The Owner and the Owner's authorized Representatives have the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, to limit the surface area of erodible earth material exposed by excavation, borrow, and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams.

3.3 CONSTRUCTION DETAILS

- A. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding, mulching, and other specified slope protection work in stages as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design state; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices but are not associated with permanent control features on the project.
- B. Where erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.
- C. The Owner will limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.
- D. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or as ordered by the Owner, such work shall be performed by the Contractor at his/her own expense.
- E. The Owner may increase or decrease the area of erodible earth material to be exposed at one time as determined by analysis of project conditions.
- F. The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor during the construction period.

- G. Whenever construction equipment must cross watercourses at frequent intervals, and such crossings will adversely affect the sediment levels, temporary structures must be provided and not alter watercourse flow or sedimentation
- H. Pollutants including fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto.

END OF SECTION 31 25 00

SECTION 33 05 13 - PRECAST CONCRETE WASTEWATER STRUCTURES

- A. Inspection on delivery: Accept materials on site in manufacturer's original packaging and inspect for damage. If any manhole section is damaged in the process of transportation and handling, reject and immediately remove such sections from the site, and replace the damaged manhole sections at no increase in contract price.
- B. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing, and moving precast structures.
- C. Storage:
 - 1. Store precast concrete structures to prevent damage to owner's property or other public or private property.
 - 2. Repair property damaged from materials storage.
- D. Manufacturers:
 - 1. County Materials
 - 2. Oldcastle Precast, Inc.
 - 3. Rinker Materials.
 - 4. Approved Equal.
- E. Sections:
 - 1. Description: Reinforced precast concrete conforming to ASTM C478 and ASTM A1064, with 28-day compressive strength of 5000 psi, and with watertight gaskets conforming to ASTM C923.
 - 2. Joints:
 - i. Conforming to ASTM C443.
 - ii. Maximum leakage: 0.025 gal. Per hour per foot of joint at 3 feet of head.
 - 3. Manholes: 48-inch riser and eccentric cone with grade rings and cast-iron frame and cover with 24-inch access opening.
 - 4. Pump Station Wet Wells: Flat top, appropriately sized access hatch cutout to accommodate pump maintenance activities, precast base section supplied with extended buoyancy collar to withstand upward buoyant forces with groundwater at grade.
 - 5. Valve Vaults: Flat top, appropriately sized access hatch cutout to accommodate valve operation and maintenance activities
- F. Resilient Connector Manufacturers:
 - 1. Kor-N-seal, as manufactured by NPC Systems, Inc., Milford, NH.
 - 2. PSX: Positive seal, as manufactured by Press-Seal Gasket, Corp., Fort Wayne, IN.
 - 3. Approved Equal.
- G. Riser Rings Manufacturers:
 - 1. County Materials
 - 2. Oldcastle Precast, Inc.
 - 3. Rinker Materials.
 - 4. Approved Equal.
- H. Riser Rings:
 - 1. 3 inches, 4 inches, or 6 inches thick:
 - i. Material: Precast concrete.

- ii. Comply with ASTM C478.
 - 2. Less than 4 inches thick:
 - i. Material: Cast iron.
 - ii. Comply with AASHTO M306.
 - 3. Rubber seal wraps:
 - i. Wraps and band widths: Conform to ASTM C877, Type III.
 - ii. Cone/riser ring joint: Minimum 3 inches overlap.
 - iii. Frame/riser ring joint: 2 inches overlap.
 - iv. Additional bands: Overlap upper band by 2 inches.
- I. Accessories:
 - 1. Joint sealant: Comply with ASTM C990.
- J. Manufacturers:
 - 1. Ram-Nek, as manufactured by K.T. Snyder Company, Inc., Houston, TX.
 - 2. Kent-Seal, as manufactured by Hamilton-Kent, Kent, OH.
- K. Bolts:
 - 1. Stainless Steel: Comply with ASTM F593.
 - 2. Galvanized: comply with ASTM F1554.
- L. Preparation
 - 1. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on drawings to indicate its intended use.
 - 2. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
 - 3. Do not install structures where site conditions induce loads exceeding structural capacity of manholes or structures.
 - 4. Inspect precast structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.
- M. Installation
 - 1. Grout manhole benches to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel.
 - 2. Where below the groundwater table, coat exterior with two coats of bituminous interior coating at direction of the owner.
 - 3. Set manhole cover frames and covers level to correct elevations without tipping.
 - 4. Setting manholes and structures:
 - i. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
- N. Assembly:
 - 1. Assemble multi-section manholes and structures by lowering each section into excavation.
 - 2. Install rubber gasket joints between precast sections according to manufacturer's recommendations.
 - 3. Lower, set level, and firmly position base section before placing additional sections.
- O. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.

- P. Maintain alignment between sections by using guide devices affixed to lower section.
- Q. Joint sealing materials may be installed on site or at manufacturer's plant.
- R. Verify that installed manholes and structures meet required alignment and grade.
- S. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
- T. Cut pipe flush with interior of structure.
- U. Shape inverts through manhole and structures as indicated on details.
- V. Sanitary Manhole Drop Connections:
 - 1. Construct drop connections into sanitary manholes as indicated on details.
- W. Castings:
 - 1. Set frame and cover 1.5 feet above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame. Embed frames in mortar. Provide wedges or shims for accurate and level placing of the frames.
 - 2. Connections to riser section: manufacture riser sections with openings properly located for making connections to sewers. Unless otherwise shown or permitted, provide 6 inches minimum distance between a joint in a manhole section and the nearest edge of an opening for a connecting sewer. Make the diameter of such openings to be not more than 4 inches larger than the outside diameter of the pipe to be connected.
 - 3. Lift holes: Provide lift holes that are formed, tapered, or drilled. Repair lift holes in a clean, workmanlike manner using a conical shaped pre-cast plug, properly sealed in place using non-shrink cement grout or an expanding portland cement mixture such as Octocrete as manufactured by IPA Systems, Inc. In accordance with manufacturer's application instruction.
 - 4. Adjusting rings and external chimney seal: Provide a soiltight seal between the precast manhole and adjusting ring, and each adjoining adjusting ring, and between the adjusting ring and casting by the use of mortar. Seal joints both internally and externally.
- X. Source Quality Control
 - 1. Accept that the quality of all materials, the process of manufacture, and the finished precast manhole or structure is subject to inspection and approval by the engineer. The owner or engineer may make such inspection at the place of manufacture, on the work after delivery or at both places. The owner or engineer may reject any precast manhole or structure at any time on account of failure to meet any of the specifications' requirements even though sample manhole sections may have been accepted as satisfactory at the place of manufacture.
 - 2. The owner reserves the right to core manholes either at the job site or point of delivery to validate strength of concrete and placement of steel. If cores fail to demonstrate the required strength or indicate incorrect placement of reinforcing steel, reject all sections not previously tested until sufficient additional cores are tested, at no increase in contract amount, to substantiate conformance to these requirements.
 - 3. Prior to being installed, each precast manhole or structure shall be carefully inspected. Reject those not meeting the specifications and replace at the contractor's expense.

4. Acceptance: base acceptance of manholes passing a proof-of-design test in accordance with ASTM C478

SECTION 33 05 52

REINFORCED CONCRETE SEWER PIPE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Furnishing and installing reinforced concrete sewer pipe, fittings and specials.
- B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:
 - 1. Section 01 45 50 - Leakage Tests
 - 2. Section 33 05 50 - Laying and Jointing Buried Pipelines
 - 3. Section 33 05 54 - Plastic Sheet Lining

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
 - 2. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric).
 - 3. ASTM C 497 - Specification for Testing Concrete Pipe and Tile.

1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Shop Drawings: Submit complete shop drawings for all diameters and classes of reinforced concrete pipe, fittings and specials showing dimensions, strength and materials specifications and standards, joint details, reinforcement position and plastic sheet lining details for approval prior to manufacture.
- C. Materials Compliance: Submit notarized affidavits of all materials compliance with ASTM C 76.

- D. Product Compliance: Submit notarized affidavit of pipe compliance with ASTM C 76 and these specifications.
- E. Joint Compliance: Submit notarized affidavit of joint compliance with ASTM C 443 and these specifications.
- F. Quality Control: Submit certified results of all shop tests for approval.

1.4 QUALITY ASSURANCE

- A. General: Provide concrete sewer pipe, fittings and specials that are precast or machine made and are the product of a concern that can demonstrate by tests and installation records satisfactory experience in manufacturing concrete pipe of the quality and type specified.
- B. Reinforced Concrete Pipe: Provide reinforced concrete pipe meeting the requirements of ASTM C 76 and these specifications.
- C. Joints: Provide joints for pipe, fittings and specials meeting the requirements of ASTM C 443 and these specifications.

PART 2 PRODUCT

2.1 REINFORCED CONCRETE PIPE

- A. General: Manufacture all reinforced concrete pipe in lengths of not more than 16 feet and not less than 7-1/2 feet, except where shorter lengths are required for pipeline curves or at junctions with structures. Do not use admixtures or blends in concrete without prior approval.
- B. Design: Provide the classes of reinforced concrete sewer pipe as shown or specified. Conform pipe designs with the following requirements.
 - 1. Use diameter, wall thickness, compressive strength of concrete and area of circumferential reinforcement as prescribed for Classes I to IV in Tables 1 to 5 in ASTM C 76, except do not use Wall A thickness, elliptical reinforcing cages or quadrant reinforcing mats. Do not substitute modified designs for designs shown in the Tables.
 - 2. Provide special designs only for pipe with diameters and loads beyond those shown in Tables 1 to 5, pipe diameters that do not have steel reinforcement areas shown in the Tables and pipe subject to thrust forces encountered in

jacking operations. Conform special designs with the requirements of Section 7.2.2 of ASTM C 76, except do not use Wall A thickness, elliptical reinforcing cages or quadrant reinforcing mats without prior approval. Retain a Registered Professional Engineer, licensed to practice structural engineering in the state in which the pipe will be installed, to prepare, sign and seal all special designs for pipe.

2.2 REINFORCED CONCRETE FITTINGS AND SPECIALS

- A. General: Provide reinforced concrete fittings and specials where shown, specified or required, and manufactured in accordance with the applicable sections of the respective standard for the adjoining pipe. Provide joints the same as in the adjoining pipe. Provide the interior surface of bends of the same smoothness and diameter as the adjoining pipe. Provide the center line radius of curvature of bends to be equal, in dimension, to the inside diameter of the pipe.
- B. Strength: Design all reinforced concrete fittings and specials to have the same strength as the class of the adjoining pipe. Retain a Registered Professional Engineer, licensed to practice structural engineering in the state in which the pipe will be installed to prepare, sign and seal all designs for fittings and specials.

2.3 JOINTS

- A. Manufacture all reinforced concrete sewer pipe, fittings and specials with watertight joints using rubber gaskets in accordance with the requirements of ASTM C 443. Provide a preformed groove in the tongue or spigot of sufficient depth to hold the gasket securely in place and produce the proper gasket compression.

2.4 CURING

- A. Cure all pipe, fittings and specials by steam or membrane curing. Water curing is not permitted.

2.5 SHOP TESTING

- A. General: Test concrete sewer pipe in accordance with the applicable provisions of ASTM C 497, as required by the ASTM Specification for the pipe and as specified herein.
- B. Basis of Acceptance: Conform the basis of acceptance for reinforced concrete pipe with Section 5.1.1 of ASTM C 76 and these specifications.

- C. Proof-of-Adequacy Tests for Special Designs: Prior to manufacturing production run pipe of special design, test one pipe of at least four feet in length of each diameter and class by the three-edge-bearing method to confirm that the pipe meets both the 0.01-inch crack and ultimate load requirements for which it is designed.
- D. Joint Adequacy Tests: Prior to manufacturing production run pipe, fittings and specials, conduct all tests required by Sections 9 and 10 of ASTM C 443 for each diameter of pipe.
- E. Finished Pipe Tests: Test one to three pipe sections of each diameter and class out of the first 100 pipe sections manufactured, or fraction thereof, by the three-edge-bearing method in accordance with Section 11.3 of ASTM C 76. The ENGINEER will select and determine the number of pipe sections to be tested. Test one pipe section, selected by the ENGINEER, of each diameter and class from each subsequent lot of 100 pipe sections manufactured, or fraction thereof.
- F. Test Witnessing: Arrange for a qualified representative of an independent testing laboratory to witness all tests and provide certified test results.
- G. Costs of Tests: Pay all costs associated with tests and test witnessing.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all reinforced concrete sewer pipe, fittings and specials in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

3.2 LEAKAGE TESTS

- A. Test the reinforced concrete sewers for leakage after completion in accordance with Section 01 45 50.

3.3 SCHEDULES

- A. Refer to the schedule contained in Section 33 05 50 for information on the piping that is to be constructed using the pipe materials and methods specified herein.

END OF SECTION

SECTION 33 31 13 - SANITARY SEWER

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' documented experience.
- B. Inspection on Delivery: Accept materials on site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Store valves in shipping containers with labeling in place.
- D. Protection:
 - 1. Block individual and stockpiled pipe lengths to prevent moving.
 - 2. Provide additional protection according to manufacturer instructions.
- E. Plastic Pipe:
 - 1. Material: Polyvinyl Chloride (PVC).
 - 2. Comply with AWWA C900 and DR 18, unless otherwise specified.
 - 3. Inside Nominal Diameter: As shown on drawings.
 - 4. End connections: Bell and spigot style, with rubber-ring-sealed gasket joint.
 - 5. Fittings: PVC.
 - 6. Joints:
 - i. Elastomeric Gaskets.
 - ii. Comply with ASTM F477.
- F. HDPE Pipe: HDPE sewer pipe shall meet the requirements of AWWA C906. Pipe shall meet type III, Class B or C, Category 5, and Grade P34 per ASTM D1248.
 - 1. HDPE must have three equally spaced horizontal colored marking stripes. Green stripes shall be used for sanitary sewer pipe.
 - 2. Molded fittings shall be manufactured in accordance with ASTM D3261 and will be so marked. Each production lot of molded fittings will be subjected to the tests required under ASTM D3261.
 - 3. HDPE pipe may be joined by means of flange adapters with back-up rings or mechanical coupling adapters designed for joining polyethylene pipe or for joining polyethylene pipe to another material. Flange and mechanical joint adapters shall be made with sufficient through-bore length to be clamped in a butt fusion joining machine without the use of a stub-end holder. Adapter shall be made from the same resin as the pipe, the sealing surface of the adapters shall be machined with a series of small V-shaped grooves to provide gasketless sealing. Adapters will be rated for full test pressure. For flange adapters, provide a full face neoprene gasket, conforming to ANSI B16.21.
- G. Tracer Wire
 - 1. A green-coated number 12 AWG copper tracer wire shall be installed the entire length of the HDPE and plastic piping.
 - 2. Tracer wire shall be extended into all valve vaults and valve boxes a minimum of 5 feet from each direction.
 - 3. Continuity of tracer wire shall be documented by testing prior to acceptance.
- H. Flexible Couplings
 - 1. Manufacturers:

- i. Fernco, Inc.
 - ii. Approved Equal.
 2. Description:
 - i. Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling.
 - ii. Attachment: Two stainless-steel clamps, screws, and housings.
- I. Sewer Installation:
 1. Install PVC pipe, fittings, and accessories according to ASTM D2321, and seal joints watertight.
 2. Install all buried HDPE pipe and fittings in accordance with the manufacturer's recommendations.
 3. Any pipe showing a distinct crack with no evidence of incipient fracture beyond the limits of the visible crack, if approved, may have the cracked portion cut off by, and at the expense of, the contractor before the pipe is laid so that the pipe used is perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack.
 4. Cutting of the gravity sewer pipe shall be done in a neat and workmanlike manner without damage to the pipe lining. Unless otherwise authorized by the engineer, all pipe cutting shall be done by means of an approved type of power cutter. The use of hammer and chisel, or any other method with results in rough edges, chipped or damaged pipe, is prohibited.
 5. Lay pipe to slope gradients as indicated on drawings.
 6. Maximum variation from indicated slope: 1/8 inch in 10 feet.
 7. Each pipe section shall be placed into position in the trench in such a manner and by such means required to cause no injury to the pipe, persons, or to any property.
 8. Begin at downstream end and progress upstream.
 9. Assemble and handle pipe according to manufacturer's instructions, except as may be modified on drawings or by engineer.
 10. Keep pipe and fittings clean until work has been completed and accepted by engineer.
 11. Furnish slings, straps, and/or approved devices to provide satisfactory support of the pipe when it is lifted. Transportation from storage areas to the trench shall be restricted to operations which can cause no damage to the pipe or lining.
 12. The pipe shall not be dropped from trucks onto the ground or into the trench.
 13. Damaged pipe coating and/or lining shall be restored and approved by the engineer before installation.
 14. Polyethylene wrap: wrap all ductile iron pipe in polyethylene wrap conforming to the requirements of ANSI A21.5.
 15. Cap open ends during periods of work stoppage.
 16. Lay bell and spigot pipe with bells upstream.
 17. Do not displace or damage pipe when compacting.
 18. Connect pipe to existing sewer system as shown on drawings.
- J. Request inspection by owner or owner's representative prior to and immediately after placing bedding.

SECTION 33 31 20 – FORCE MAIN

PART 1 – GENERAL

- A. All force main and its installation shall meet the applicable NineStar Standards.
- B. Force main shall be constructed of PVC Pipe (DR 18) as indicated on the drawings and specified herein.
- C. PVC Pipe: PVC sewer pipe shall meet the requirements of AWWA C900.
 - 1. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F477.
 - 2. Fittings are to be the same size as pipe. Push-on fittings are to be in accordance with ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psi. Flanged fittings are to be in accordance with ANSI A 21.10; ductile iron ANSI A21.11 joints, gaskets, and lubricants; pressure rated at 250 psi. Mechanical joint fittings are to be in accordance with ANSI A 21.11; pressure rated at 250 psi.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 33 32 19 - PUBLIC UTILITY WASTEWATER PUMPING STATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public wastewater pumping station.
2. Initial operation of public pumping station.
3. Pump station valve vault.

B. Related Requirements:

1. Section 31 23 17 - Trenching.
2. Section 31 23 23 - Fill.
3. Section 33 05 13 - Precast Concrete Wastewater Utility Structures.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
4. ASTM F594 - Standard Specification for Stainless Steel Nuts

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data:

1. Submit to the utility for review and approval three (3) sets of shop drawings for each pumping station.
 - a. Manufacturer catalog data for basin, cover, hinged door, slide rail assembly, discharge piping and fittings, valves, junction box, level controls, and control panel.
 - b. Manufacturer pump catalog data, performance curve, breakaway fittings data, and access frame data.
 - c. Control panel data and panel wiring schematic.

- d. Certificate of compliance with the drawings and specifications, noting all deviations from the drawings and specifications.
 - e. Dimensional cross section drawings of pump.
 - f. Parts list with materials of construction identified.
 - g. Equipment weights and lifting points.
 - h. Spare parts list.
 - i. Warranty.
 - j. Painting procedure.
 - k. Recommendations for short and long-term storage.
 - l. ISO 9001 Certification.
- C. Test and Evaluation Reports: Submit written report showing that factory pump inspections and tests have been successfully performed.
 - D. Manufacturer Instructions: Submit manufacturer's instructions for basin, pump, panel systems, valves, and installation procedures.
 - E. Source Quality-Control Submittals: Indicate results of shop tests and inspections. Provide certified performance curves for each pump. Results shall be certified by a registered Professional Engineer.
 - F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Project Record Documents: Record actual locations of pumping stations, including basins and control panel. Record actual locations and inverts of buried pipe, components, and connections.
- C. Submit executed certification of pumping stations after performance testing.
- D. Operation and Maintenance Data: Submit operating and maintenance requirements for pumping station and schedule of recommended maintenance.

1.5 QUALITY ASSURANCE

- A. Perform Work according to State of Indiana and Owner standards.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Transport and handle precast concrete units with equipment designed to protect units from damage. Do not place concrete units in position to cause overstress, warping, or twisting.
- D. Store materials according to manufacturer instructions.
- E. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide temporary end caps and closures on piping and fittings, and maintain in place until installation.
 - 3. Provide additional protection according to manufacturer instructions.
- F. Deliver and store valves in shipping containers with labeling in place.

1.8 AMBIENT CONDITIONS

- A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Do not install basin when bedding is wet or frozen.
- C. Dewater to keep excavations dry.

1.9 SPARE PARTS

- A. General: Furnish the following spare parts:
 - 1. One lot of:
 - a. Mechanical seals
 - b. O-rings
 - c. Gaskets

1.10 WARRANTY

- A. General: The manufacturer is to warranty the equipment supplied to the Owner against defects in material and workmanship for a period of at least one (1) year. Warranty period commences at date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Pumping Stations:

1. Configurations: Wheatland Regional Lift Station is duplex.
2. Assembly: Field.
3. Wet Well: Precast concrete structure per Section 33 05 13 - Precast Concrete Wastewater Utility Structures.
4. Controls:
 - a. Multiple.
 - b. Automatic.

B. General: Provide pumping units of the submersible, non-clog, centrifugal, solids-handling type, each driven by an explosion proof electric motor. Install the pumping equipment in a suitable arrangement for installation in the spaces shown without appreciable revision of the piping. Provide the pumping units design to prevent premature wear and clogging.

C. Fluid Character: Provide pumping units to pump raw unscreened sanitary sewage that can pass 3-inch solids without clogging.

D. Operating Characteristics: Design each pump to have a continuously rising characteristic curve from the rating point specified to shutoff. Design the pump to have a characteristic curve passing through the rating point and certified to meet or exceed the specified heads and capacities, all within the Hydraulic Institute test tolerances. Provide a pump motor that is non-overloading at the specified duty point.

2.2 PERFORMANCE AND DESIGN CRITERIA

A. Operating Requirements: Provide pumps certified to operate at the specified capacities and heads over the range of specified operating conditions without cavitation, undue noise or vibration. Furnish pumps meeting the following requirements:

<u>Item Description</u>	<u>Wheatland Regional Lift Station</u>
Number of Pumps	2
Pump Designations	P1
	P2
Capacity at rating point, gpm	175 gpm
Total dynamic head at rating point, feet	49 ft.
Shutoff head, feet	67.5 ft.

Pump guaranteed efficiency, per-cent	39.6 %
Pump discharge diameter, inches	3 in. minimum
Pump speed, approximate, RPM	1750 RPM
Motor speed, maximum, RPM	1800 RPM
Motor Horsepower, max HP	7.5 HP

- B. Wet Well Wall: Sufficient to withstand water-saturated sand load of 120 pcf.
- C. Wet Well Cover: Support live load of 150 psf.
- D. Operation Sequences: Pump station controls are to be set-up in a lead/lag configuration. The Lead and Lag pumps shall switch designation on each pump cycle. Coordinate with Owner on further requirements regarding their standard Omni-site system.
- E. Sound, Vibration, and Thermal Control:
 - 1. Dampen or suppress noise.
 - 2. Absorb vibration.
 - 3. Accommodate thermal expansion and stresses.
 - 4. Adjust or correct for misalignment in piping systems.

2.3 WET WELL

- A. Description:
 - 1. Submersible duplex basin system, including cover with vent and door, rail assemblies, discharge and fittings, ball valves, junction box, and level controls.
 - 2. Gravity Sewer Inlet Size: As shown on Drawings.
 - 3. Pump Discharge Sizes: As shown on Drawings.
- B. Concrete Wet Well:
 - 1. Description: Precast reinforced concrete wet well, as specified in Section 33 05 13 – Precast Concrete Wastewater Utility Structures.
 - 2. Minimum wall thickness: As shown on Drawings.
 - 3. Diameter: As shown on Drawings.
- C. Concrete Cover: Reinforced concrete as specified in Section 33 05 13 - Precast Concrete Wastewater Utility Structures.
- D. Access Hatch: As shown on Drawings.

- E. Station Piping: As shown on Drawings.
- F. Rail System: Slide rail assembly consisting of Type 316 stainless-steel upper and lower rail brackets and pump guide brackets.
- G. Junction Box: NEMA 250 Type 6, with cable grips for incoming direct-burial cable. Provide only as required, see Paragraph 2.4 – L. of this Section.
- H. Electrical:
 - 1. Provide cable grips for direct-burial cable for field installation.
 - 2. Provide explosion-proof equipment, supplies, and fittings.
- I. Float Bracket: As shown on Drawings.
- J. Coating:
 - 1. Inside of wet well shall be coated or impregnated with a material to discourage grease buildup and or decalcification by hydrogen sulfide.

2.4 PUMPS

- A. Manufacturers:
 - 1. Barnes
 - 2. Hydromatic
 - 3. Approved Equal
- B. Description:
 - 1. Submersible non-clog effluent pumps with vertical discharge, fittings, piping, check valve, and pump brackets.
 - 2. Maximum Effluent Temperature: 140 degrees F.
 - 3. Both pumps should be equipped with a mix-flush valve similar to Flygt to minimize grease buildup.
 - 4. Station pumps shall be furnished with variable frequency drives (VFD) to reduce system hydraulic surges.
 - 5. Pumps shall be equipped with sliding brackets or rail guides attached to each pump.
- C. Volute:
 - 1. Material: Gray cast iron.
 - 2. Comply with ASTM A48, Class 30.
 - 3. Shall be fit with a replaceable bronze wear ring to minimize wear on the impeller and help achieve longer balance operating life.
- D. Motor Housing:

1. Material: Gray cast iron.
 2. Comply with ASTM A48, Class 30.
 3. Insulation utilized in the stator windings shall be Class F with maximum temperature capability of 155 degrees Celsius.
 4. Housing shall be filled with a high dielectric oil to give superior heat transfer and allow the bearing to run in a clean, well lubricated environment or the housing shall be filled with grease lubricated bearing.
- E. Seal Housing:
1. Material: Gray cast iron.
 2. Comply with ASTM A48, Class 30.
- F. Impeller:
1. Design: 2-vane, enclosed, non-clog, statically and dynamically balanced, ISO G6.3, and or ductile iron material.
 2. Volute Case Wear Ring: 85-5-5-5 red brass or 80-10-10 bronze.
 3. Slip or taper fit with key to lock impeller to driving shaft.
 4. Capable of handing a minimum three (3) inch sphere solids, fibrous material, heavy sludge, and other matter found in normal sewage applications
 5. Fasteners must be made of Type 316 stainless steel
- G. Pump Mounting Base
1. ANSI 125 lb. flange
 2. Mating surfaces with watertight sealing: nitrile rubber O-rings
 3. Base plates shall be anchored in place utilizing epoxy type anchors with stainless steel studs and nuts as manufactured by HILTI Fasteners, Inc. or equal.
- H. Shaft: Type 416 stainless steel. Supported by ball bearings
- I. Hardware: Type 316 stainless steel.
1. Where anchor bolts are required provide Hilti HY 200 epoxy with 316 stainless steel threaded rod.
- J. Paint: As shown in Drawings.
- K. Seal:
1. Description:
 - a. All mating surfaces shall be machined and fitted with nitrile rubber O-rings.
 - b. The seals shall require neither maintenance nor adjustment and shall be easily inspected and replaceable.
 - c. The shaft sealing system shall be capable of operating submerged to pressures equivalent to two hundred (200) feet.
 - d. No seal damage shall result from operating the pump unit out of its liquid environment.

2. Design: Tandem mechanical, oil-filled reservoir.
 - a. Lower Seal: One (1) stationary seat and one (1) rotating ring held by a spring. Removable without disassembling the seal chamber.
 - b. Upper Seal: One (1) stationary seat and one (1) rotating ring held by a spring.
 - c. Provided lower and upper seals with their own independent spring systems.
 3. Materials:
 - a. Rotating Faces: Silicon-Carbide.
 - b. Stationary Faces: Silicon-Carbide.
 - c. Hardware: Type 300 stainless steel.
 4. Seal leak detection probe and warning system.
 - a. The seal chamber shall also be equipped with a seal failure sensor probe which will sense water intrusion through the lower seal. This sensor is to be connected to an alarm in the control panel to indicate lower seal failure.
- L. Electrical Cable:
1. Length: Length to be coordinated in the field. Provide cable of sufficient length to eliminate the need for a splice or junction box between the pumps and the Control Panel.
 2. Nitrile O-ring on beveled edge at cord cap assembly where bolted to the connection box assembly and to the motor to assure proper sealing.
- M. Speed: 1750 rpm.
- N. Upper Bearing:
1. Design: Single row, ball.
 2. Lubrication: Dielectric oil.
 3. Load: Radial.
 4. Minimum B-10 Life: 100,000 hours.
- O. Operation:
1. Electrical Characteristics:
 - a. Voltage: 460 volts, three phase, 60 Hz.
 - b. Power: Min 7.5 HP
 - c. Controls: Mount double electrode in seal chamber to actuate remote alarm when water is detected in seal chamber.
- P. Motors:
1. Premium efficiency, NEMA B Design
 2. Stator, rotor and bearings mounted in a sealed submersible type housing.
 3. Stator windings: Class H insulation (155°C or 311°F) and a dielectric oil-filled motor, and on-winding thermal sensors. Air-filled motor designs are not acceptable.

4. Capable of being operated partially or completely submerged in the liquid being pumped.
5. Provide stators secured with removable end ring and threaded fasteners so they may be easily removed.
6. Heat sensors: low resistance, bi-metal disc, temperature sensitive; mounted directly on the stator windings and sized to open at 120°C and automatically reset at 30–35°C differential. The sensors shall be connected in series with motor starter coil so that the starter shall be equipped with 3 leg overload heaters making all normal overloads protected by the starter.

Q. Lifting Device: 316 Stainless steel lifting chain.

1. Provide a stainless-steel lifting chain or manufacturer's pump removal system similar to the Flygt lift of adequate length for the basin depth for each pump.
2. Each pump shall be equipped with a permanent stationary lifting handle with a minimum clearance of 12 inches between the top of the pump and the bottom of the handle.

R. Rail System

1. Rail system must ensure easy removal of the pump and motor assembly for inspection and service
2. System shall not require a man to enter the wet well to remove the pump and motor assembly.
3. Provide two (2) guiderails T-bar or other suitable guide system for each pump.

S. Warranty

1. Pump warranty shall be provided by the pump manufacturer and shall warrant the units being supplied against defects in workmanship and materials for a period of five (5) years under normal use, operation and service.
2. A copy of the warranty statement shall be submitted with the approval drawings.

2.5 VALVE VAULT

A. Description:

1. Precast concrete box with access hatch, containing discharge lines from the wet well pumps, each line with:
 - a. Lever and weight wing arm check valve.
 - 1) In accordance with the Drawings and as follows:
 - a) General: Provide single disc swing check valves designed to allow a full diameter passage and to operate with a minimum loss of pressure. Provide check valves that meet the requirements of AWWA C508.
 - b) Design: Equip check valves with bronze renewable seat rings, bronze discs or disc rings and bronze disc hinge bushings and pins. Carefully mount discs and provide discs that swivel in disc hinges. Provide pins, discs and other parts that are noncorrosive, non-sticking and properly cured to operate satisfactorily within a temperature range of 34 to 100 degrees Fahrenheit and with the fluids or gases specified.

b. Shut-off plug valve.

1) In accordance with the Drawings and as follows:

- a) General: Provide quarter turn valves having an eccentric action that causes the plug to rise off the seat contact during the opening movement rather than sliding from its seat.
- b) Plugs: Provide plug valves with Buna-N faced plugs.
- c) Materials: Construct plug valves of cast iron or semi-steel at least equal to ASTM A126, Class B. Construct the body seats with a welded-in overlay, of not less than 90 percent pure nickel, on all surfaces contacting the plug face. Make the overlay a minimum of 1/16-inch thick. Provide zinc plated bonnet bolts, studs, and nuts.
- d) Seat Adjustment: Make the water-tightness of the valve seating adjustable. Provide a seating adjustment device that is external to the valve and that can be used without the need to remove the valve from the piping and with the valve under pressure.
- e) Lubrication: Furnish plug valves with oil impregnated, permanently lubricated, Type 316 stainless steel bearings in the upper and lower journals.
- f) Stem Seal: Provide a stem seal consisting of multiple, self-adjusting and replaceable chevron type packing rings and a packing gland or provide two replaceable, self-adjusting, U-cup seals. Make the stem seal adjustable and replaceable without removing the valve from the piping and without the need to disassemble the valve and operator. For buried or submerged service, provide a sealed enclosure to keep the stem seal clean.
- g) Valve Port: Construct the valve with a minimum port area of 100 percent of the full area of the pipe in which the valve is installed.
- h) Position Indicator: Equip plug valves, except for buried or submerged service, with external visible indication of the plug position.
- i) Operators: Equip valves with lever operators with a gearbox.

2) A minimum clearance of twelve (12) inches shall be allowed from the bottom of the valves to invert of the pipe.

B. Precast Concrete Vault Structure: Precast reinforced concrete basin, as specified in Section 33 05 13 – Precast Concrete Wastewater Utility Structures.

1. Precast reinforced concrete must meet the requirements of ASTM C-478.
2. Minimum valve vault diameter shall be 6'-0".
3. All joints between valve vault sections shall be made with an approved rubber O-ring in accordance with ASTM C-443 and a 12-inch diameter non-asphaltic mastic conforming to AASHTO M-195 and Federal Specification SS-521-A.
4. Outside of precast concrete sections to be coated with a waterproofing material.

5. Basin and valve vault shall be enclosed at grade level with a reinforced concrete pad rectangular in shape and extending a minimum of 1'-0" from the chambers outside dimension.

C. Access Hatch

1. Pump supplier shall provide aluminum door access hatch frame and door assemblies to be installed in the concrete basin top.
 - a. Door assemblies must provide lifting handle, safety latch to hold door open in the key position and a hasp suitable for padlock.
 - b. Doors shall have a nonskid finish and be designed for light, medium or heavy duty, depending on the location of the pumping station.
2. Single doors or dual opening door of dual-door assemblies shall open towards the control panel to provide a physical barrier between the control panel and the wet well.

D. Piping Inside Vault: Ductile iron, as shown on the Drawings.

2.6 MATERIALS

A. Bedding, Ballast, and Backfill.

1. Bedding: Structural fill as specified in Section 31 23 23 – Fill.
2. Soil Backfill to Finish Grade: As specified in Section 31 23 23 – Fill.

2.7 ACCESSORIES

A. Anchor Bolts, Nuts, and Washers:

1. Bent Anchor Bolts: Comply with ASTM F593.
2. Nuts: Comply with ASTM F594.
3. Washers: Comply with ASTM F593.
4. Epoxy adhesive: Hilti HY200

B. Fresh Water Supply: As indicated on Drawings.

2.8 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Inspection:

1. Verify that motor voltage and frequency are as shown on nameplate.
2. Verify that motor and cable insulation test for moisture content or insulation defects comply with UL 83.

- C. Pump Shop Tests: Perform a certified shop test on each pumping unit in accordance with the test code of the Hydraulic Institute, except as modified herein. Drive each pump by its own drive unit during the shop test.
1. Test at rated speed to determine the curves of head brake horsepower, and efficiency as a function of capacity. Take a minimum of 6 points, including shutoff. Take at least one point as near as possible to each specified condition of head and capacity. Take the remaining points at capacities necessary to provide a uniform distribution of data. Express capacity in gallons per minute and express total dynamic head in feet of water. Furnish certified copies of the curves, raw test data, calculated results and sufficient information for computation and plotting of the curves.
 2. Subject each pump to a hydrostatic test in the shop. Use a test pressure of not less than 1.5 times the shutoff head of the pump as shown by the characteristic curve. Under this test pressure, demonstrate that no part shows undue deflection or leakage or other defects. Provide certification of the hydrostatic tests.
- D. Eccentric Plug Valve Leakage Test: Perform a plug leakage shop test on each eccentric plug valve with the plug in the closed position. Unless otherwise specified, perform the leakage test with a minimum pressure of 150 pounds per square inch (gauge) applied sequentially to both the upstream and downstream faces of the plug. Perform the test for a minimum duration of 15 seconds. Demonstrate that there is no leakage past the plug.
- E. Eccentric Plug Valve Hydrostatic Test: Perform hydrostatic shop pressure tests on each eccentric plug valve, hydrostatic shop pressure tests with the plug open and with the plug closed. Perform the hydrostatic tests with a minimum pressure that is at least equal to the test pressure specified for the pipeline in which the valve is installed. Perform the test for a minimum duration of 30 seconds. Demonstrate with the hydrostatic tests that the valve is structurally sound and that there are no leaks through the external surfaces of the valve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Verify that inlet and discharge piping connections size, location, and elevation as indicated on Drawings.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Establish minimum separation of 10 feet from water utility lines. For other utilities, establish minimum separation distances in accordance with utility's standards.

- C. Protect piping systems from entry of foreign materials and water by using temporary covers, completing sections of Work, and isolating parts of completed system.

3.3 INSTALLATION

A. Excavation:

- 1. Excavate to required elevation to install basin on undisturbed subgrade as specified in Section 31 23 16 – Excavation.

B. Wet Well Basin and Valve Vault:

- 1. Install as specified in Section 33 05 13 – Precast Concrete Wastewater Utility Structures.
- 2. Seal cover penetrations with industrial silicone sealant.
- 3. Set cover frames and covers level, without tipping, to correct elevations.
- 4. Assemble basin components, including inlet hub/fitting, discharge hub, cover, pump support rail system, level controls, and junction box.
- 5. Connect to inlet and discharge piping with flexible connector.
- 6. Seal joints watertight where inlet and discharge pipes penetrate sump wall.

C. Pumps:

- 1. Install pumps, including fittings, brackets, discharge piping, valves, lifting device, and discharge.
- 2. Wire pump to junction box.

D. Valves:

- 1. Eccentric Plug Valves: Install eccentric plug valves with the plug and shaft in orientations recommended by the manufacturer.

E. Control Panel: See Electrical and Control Specifications.

F. Backfilling:

- 1. Backfill basin and direct-burial cable as specified in Section 31 23 23 - Fill.
- 2. Maintain optimum moisture content of fill material to attain required compaction density.
- 3. After hydraulic test, evenly backfill around entire periphery of basin by hand, place backfill material and hand tamp in 6-inch compacted layers to finish grade, and compact to 95% Standard Proctor Density.
- 4. Do not use wheeled or tracked vehicles for tamping.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements.

B. Pre-operational Checks:

1. Check pump and motor alignment.
2. Check for proper motor rotation.
3. Check pump and drive units for proper lubrication.
4. Check valves for proper operation.

C. Startup and Performance Testing:

1. Notify Engineer and Owner, three days prior to flow rate testing.
2. Startup and Initial Testing: Coordinate and operate pumps in conjunction with other construction.
3. Hydraulically test station to performance requirements by receiving, pumping, and discharging 600 gal of water to and from basin.
4. Confirm general sequencing of pump, MultiTrode, and float operations at basin and control panel are according to performance requirements.
5. Document and certify startup results in startup report.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace system components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.
3. Document adjustments, repairs, and replacements in manufacturer's field services certification.

E. Document and certify startup and testing results in written report.

F. Compaction Testing: As specified in Section 31 23 23 - Fill.

3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust basin, pump, and control panel systems such that station operates to performance requirements and according to Specifications.

3.6 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 33 32 19

SECTION 46 07 53
WASTEWATER TREATMENT PACKAGE PLANT

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Provide and install a wastewater treatment package plant based on the SEQUOX activated sludge process, along with the DO₂ optimizerTM / D.O. control process at the Wheatland Wastewater Treatment Facility.
- B. The wastewater treatment process designs shall be based on composite sewage samples of the average daily flow with the following influent characteristics: 220 mg/L BOD₅, 220 mg/L TSS, and 35 mg/L NH₃-N to produce final treatment effluent with 10 mg/L BOD₅, 12 mg/L TSS, and 1.1 mg/L NH₃-N.
- C. The package WWTP supplier shall perform and make the following arrangements:
 - 1. Provide consultation assistance to contractor for installation of the SEQUOX activated sludge process equipment, along with the DO₂ optimizer^r / D.O. control instruments in position as shown on the drawings.
 - 2. Assemble into position, at the locations shown on the drawings, the following equipment: clarifier/access bridges, clarifier internals and gear drive, decant airlifts, aeration blowers and air distribution header, diffuser drop assemblies, return activated sludge (RAS) air lift, waste sludge (WAS) air lift, clarifier effluent trough, WAS pump, telescoping valve for sludge tank decanting, compressor packages and air dryer system, air distribution piping including interconnection of piping with valves fittings and pipe supports.
 - 3. Anchors and fasteners. Field assembly including bolting or welding when required.
 - 4. Field Services to include verification of installed treatment units, performance testing of treatment process, and training of plant operation and maintenance.

1.2 MEASUREMENT AND PAYMENT

- A. Include all costs in the applicable bid items with price breakdown included in the Schedule of Values.
- B. Refer to Section 01 29 00 – Measurement and Payment Procedures

1.3 RELATED SECTIONS

- A. Coordinate pumps and motors with electrical work as specified in Electrical Spec Sections
- B. Provide piping, fitting and valves as specified in Division 15, Mechanical.

1.4 STANDARD REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Anti-Friction Bearing Manufacturers Association (AFBMA)
- D. Hydraulic Institute
- E. Institute of Electrical and Electronic Engineers (IEEE)
- F. National Electric Code (NEC)
- G. National Electrical Manufacturers Association (NEMA)
- H. Steel Structures Painting Council (SSPC)

1.5 SUBMITTALS

- A. Submit, in accordance with Section 01 33 00, copies of all materials required to establish compliance with this Section. Submittals shall include the following:
 - B. Certified shop and erection drawings in AutoCAD format showing all important details of construction, dimensions, and anchor bolt locations.
 - C. Descriptive literature, bulletins and/or catalogs of the equipment.
 - D. Data on the characteristics and performance of the pumps. Data shall include guaranteed performance curves, based on actual shop tests of duplicate units, which show that they meet the specified requirements for head, capacity, efficiency, and horsepower. Curves shall be submitted on 8 1/2 in by 11 in sheets.
 - E. The total weight of the equipment including weight of the single largest item.
 - F. A complete total bill of materials.
 - 1. A list of the manufacturer's recommended spare parts. Include gaskets, packing, etc., on the list. List the bearings by the bearing manufacturer's numbers only.
 - 2. Complete data on motors.
 - 3. Complete description of surface preparation and shop prime painting.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance (O&M) instructions in accordance with Section 01 78 23 - Operations and Maintenance Data. Provide the following operation and maintenance data in the O&M submittals.

- B. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.
- C. Include all approved Shop Drawings, product cut sheets, wiring diagram and control loop drawings in the O&M Manuals. Manufacturer’s Technical Manuals. Non-related sections should be crossed out to avoid confusion.
- D. Provide three (3) sets Final O&M Manuals in printed copies, each with the As Built drawings in AutoCAD drawings in 2022 format in CDs prior to final acceptance of the equipment.

PART 2 PRODUCTS

2.1 DESIGN PARAMETERS

- A. Wastewater treatment design parameters are as follows:
 - 1. Average Design Flow: 0.066 MGD
 - 2. Maximum Daily Flow: 0.259 MGD
 - 3. Peak Hour Flow: 0.264 MGD
- B. Wastewater influent characters are as follows:

Average

- 1. BOD₅: 121 lbs/day
- 2. TSS: 121 lbs/day
- 3. TKN: 24 lbs/day

C. Effluent Permit Requirements

Parameter	Summer		Winter		
	Monthly Average	Weekly Average	Monthly Average	Weekly Average	
CBOD ₅	10	15	10	15	mg/l
TSS	12	18	12	18	mg/l
Ammonia-N	1.1	1.6	1.6	2.4	mg/l

- D. Equipment to be supplied shall be furnished by Aero-Mod, Inc., or equal.

2.2 SYSTEM LAYOUT

- A. The footprint of the plant shall be as shown on the contract drawings. It shall include: one (1) selector tank, one (1) Split-ClarAto clarifier, one (1) first stage aeration tank, one (1) second stage aeration tank, one (1) aerobic digester, and one (1) sludge holding tank.
- B. All equipment in this section shall be supplied by a single manufacturer as a total system. Items to be supplied are as follows:

1. Aeration drop pipes with diffusers in various tanks
2. Pneumatically-actuated valves
3. Clarifier/RAS equipment
4. PLC-based and timer-based process control & D.O. control
5. Probe module and DO probes
6. WAS and sludge transfer airlift pump equipment
7. Submersible WAS pump equipment
8. Telescoping Valve for decanting
9. Compressed air pneumatic system
10. Concrete tank mounted aluminum walkway & handrail
11. Manual bar screen
12. Aeration blowers
13. Blower VFD controls

2.3 MANUAL BAR SCREEN

- A. Supply and install a manual bar screen in the Selector Tank with a 6" flanged connection to provide screening of raw sewage influent from the lift station at 183.3 GPM peak flow. The manual bar screen box shall be made of 10-gauge 304 stainless steel, with ½" x 2" Tivas bars to handle peak flow at minimal head loss. Provide a splash cover at the inlet and a drying deck to allow manual cleaning of the screenings. The bottom of the screen box shall allow free flow into the Selector Tank. The drying deck shall have holes spaced to allow drainage. The sidewall of the box shall serve as an overflow weir into the selector tank in the event of the screen rack being full.
- B. The bar screen box shall be provided with mounting plate and stainless steel wedge anchors for installation on top of concrete walls. One (1) rake shall be included for the operator to clear the screenings from the rack to the drying deck.

2.4 SPLIT-CLARATOR

The supplier of the Split-ClarAator clarifier equipment shall have a minimum of 40 operating installations. The Split-ClarAator clarifier equipment shall be supplied by Aero-Mod, Inc.

- A. Split ClarAator Clarifier Construction
 1. The Split ClarAator clarifier shall consist of (a) structural support frame with handrails and aluminum grating (b) coarse screening (c) a hydraulic suction hood for sludge removal (d) sludge return air lifts and MLSS return trough (e) floating skimmers (f) 3-weir level and rate control device and (g) the associated plumbing, equipment and accessories as noted herein or on the drawings.

2. The structural support frame shall be constructed of 3"x3" 304 SS rectangular tubing. The support frames will be placed into notches in the clarifier tank walls. The frame will have the MLSS return trough attached to its underside. The trough shall also be fabricated of 304 SS.
3. The hydraulic suction hood and structural support fins shall be of fiberglass. The hydraulic suction hoods will set over concrete suction hood bases on the floor of the clarifier tank.
4. For this project, **one (1) Split ClarAator clarifier module, Model 16272** shall be provided, installed, and arranged within the clarifier tankage as shown on the drawings.

B. Inlet Coarse Screens

Telene circular inlet screens shall be provided. For this project, a total of **three (3)** are required. Each inlet screen shall provide 4 linear feet of screen. The coarse screens shall consist of 1/2" wide slots on 2" centers. These screens have an 8" flange for connecting to the 8" PVC distribution piping. They are installed in the aeration tanks as per the drawings.

C. Walkways and Handrails

1. A walkway shall be provided across the entire support frame consisting of banded aluminum grating, 1" I-Bar, set into a frame made of SS.
2. A two-rail handrail system shall be supplied. Handrails shall be of 1-1/2" aluminum tubing with NU-RAIL aluminum handrail fittings (or equal). The handrail risers shall be securely mounted to the support frame and of proper length to place the top-rail 42" above the walkway.

D. Skimmers

Specially designed floating-skimmer assemblies shall be located in the clarifier chamber as per the detail drawing. Each skimmer shall consist of a formed floating head with a telescoping pipe. This assembly will insert into union and discharge up into the MLSS return trough. Air is supplied from 2" SS air pipes located on the support frame. The telescoping section shall allow unrestricted level adjustment to accommodate the rising and falling clarifier levels caused by the surge control system. The skimmers consist of a SS union and ell for connection to the RAS trough and PVC fittings and sized to remove floatables that enter the clarifier chamber.

E. Clarifier Chamber

The clarifier chamber shall be designed such that PVC pipe distribution headers are located along both sides of the outer edge of each hydraulic suction hood. These inlet headers have ports provided. The inlet headers and ports are sized to provide even distribution across

the entire settling area to prevent inlet turbulence during surge flows. There shall be **one (1)** rectangular clarifier, and the clarifier shall provide **272** square feet of surface area.

F. Sludge Returns

Return sludge airlifts made of 4" Schedule 40 PVC pipe shall be located every four feet along the apex of the hydraulic suction hoods. Each airlift rate shall be controlled by a 3/4" ball valve. A pneumatic valve on the 1-1/2" SS air supply pipe will control the air supply to the airlifts. The flow rate for each air lift can be adjusted from zero to 100 gpm and can be operated continuously or intermittently by a timer device located in the plant process control panel.

G. Effluent Collector

Two (2) SS triangular effluent collection pipes with 5/8" holes spaced at 8" CC shall be furnished along the entire support frame length for effluent withdrawal. The apex of each triangular pipe shall be located approximately 1 inch below the minimum water level within the clarifier. This submerged orifice collection pipe shall provide uniform effluent withdrawal across the entire length without regards to leveling, will not pass surface scum or floatables, and will not be adversely affected by either algae accumulation or icing.

H. Level and Rate Control

Two (2) effluent boxes with adjustable low- and high-level weirs and a submerged orifice for surge control shall be furnished on the effluent withdrawal end of each triangular collection pipe. The low-level weir will set the minimum operating level, passing flow directly to an orifice plate for surge protection. The orifice shall be sized to limit the maximum effluent rate, keeping the clarifier surface settling rates below maximum design standards. The upper edge of the orifice plate shall serve as the high-level by-pass weir to limit the maximum water level within the plant. The distance between the low- and high-level weirs shall provide 5" surge storage within the freeboard across the entire mixed liquor aeration tank. A manual swing gate valve with the orifice located on the paddle portion will allow the operator to shut off effluent from each effluent box. This allows for effluent shut off during periods of cleaning and maintenance.

2.5 WALL MOUNTED AERATORS

A. Aerators

The basins requiring aeration shall have wall-mounted aerators as shown on the plans. These aerators shall provide the necessary air required to maintain proper operation. The diffusers shall be set at a submergence depth in the aeration tank as shown on the plans. As shown on the plans, the air manifolds (drop pipes) shall be wall mounted with a SS support system. Easy diffuser removal from above the water line shall be by lightweight PVC drop pipes. Removal and replacement shall be assisted by a 1-1/2" Schedule 5 SS guide rail system. The guide rail shall be bolted to the SS wall mounting support system

in the field. No field welding shall be required.

B. Aeration Tank – First Stage

The drop pipes used in the first stage aeration basin shall be 2" sch. 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. **Six (6) Model WA-HS2-2** aerators with **two (2) 24" SS diffusers** per drop pipe are required for this tank.

C. Aeration Tank – Second Stage

The drop pipes used in the second stage aeration basin shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. **Six (6) Model WA-PS2-2** aerators with **two (2) 24" SS diffusers** per drop pipe are required for this tank.

D. Selector Tank

The drop pipe used in the selector tank shall be 2" Schedule 40 PVC pipe. A 1-1/2" stainless steel throttling ball valve along with a SS union and ell shall be supplied in the aerator upper assembly. A single 1-1/2" connection from the air header to the flex connector on the aerator assembly is required for the aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for the aerator. **Two (2) Model WAD-HSS2A-2** aerators with **two (2) 12" stainless steel diffusers** and **one (1) pneumatic diaphragm valve** per drop pipe is required for this tank.

E. Aerobic Digester Tank

The drop pipes used in the aerobic digester tanks shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. **Four (4) Model WAD-HSS2-2** aerators with **two (2) 12" SS diffusers** per drop pipe are required for these tanks.

F. Sludge Holding Tank

The drop pipes used in the aerobic digester tanks shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. **Four (4) Model WAD-HSS2-2** aerators with **two (2) 12" SS diffusers** per drop pipe are required for these

tanks.

G. Post Aeration Tank

The drop pipes used in the Post Aeration Tank shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. **One (1) Model WA-PF4/6-2** aerators with **four (4)** 0.5 m Polyurethane fine bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for the aerator per drop pipe to raise dissolved oxygen level to a minimum of 6.0 mg/L at 20°C in the Post Aeration Tank. The aerator shall have the capability to take a total of six (6) diffusers for future addition.

2.6 SLUDGE MANAGEMENT

A. Solids Wasting (WAS) Air Lift Pump – Aeration Tank to Digester Tank

The sludge wasting airlift pump shall be sized for a running time at design loading of approximately 30-90 minutes per day. All components below the water line shall be of SS. A pneumatically controlled automatic valve and a manual throttling and shut-off valve shall be supplied in the air feed line. The entire assembly shall be provided with anchor bolts. The digester shall be constructed with a notch over which a supernatant weir & baffle will be placed to control the digester water level and return displaced supernatant back to the aeration tank. For this project, **one (1) AL-300** airlift pump is required to waste mixed liquor from the aeration tank to the digester tank.

B. Supernatant Weir & Baffle

The digester shall be constructed with a notch over which a supernatant weir & baffle will be placed to control the digester water level and return displaced supernatant back to the aeration basin. For this project, **one (1)** supernatant weir & baffle assembly is required.

C. Solids Transfer Air Lift Pump – Digester Tank to Sludge Holding Tank

The sludge transfer airlift pump shall be sized for the transfer of sludge from the digester tank to the sludge holding tank. All components below the water line shall be of SS. A pneumatically controlled automatic valve and a manual throttling and shut-off valve shall be supplied in the air feed line. The entire assembly shall be provided with anchor bolts. For this project, **one (1) AL-300L** airlift pump is required to transfer sludge from the digester tank to the sludge holding tank.

D. Telescoping Valve

A 6" telescoping valve by RW Gate series RW7000S, fabricated of 304SS, shall be mounted within the sludge holding tank.

2.7 SLUDGE TRANSFER PUMP

A. Manufacturer:

The sludge transfer pump shall be manufactured by Wilo-USA of Thomasville, Georgia, or pre-approved equal. The submersible pump shall be Weil model 2572 with a 1.5 HP motor. One (1) pump shall be supplied for the Sludge Holding Tank.

B. Pump Characteristics

1. Design Flow shall be 90 gpm
2. Design Head shall be 6 ft TDH
3. Impeller Trim shall be 694
4. Motor shall be 1750 RPM, 460V/3ph/60Hz
5. Motor shall be explosion proof
6. Motor shall include a 25 ft power cable
7. Motor shall include a moisture sensor and temperature limiter
8. Pump shall be 2 inch discharge
9. Pump shall have an epoxy paint

C. Accessories

1. Pump removal system shall be model 2613-2
 - a. Removal system shall include a bronze sliding bracket
 - b. Removal system shall include an angled upper guide pipe bracket for wall mounting
2. 1" SS guide rails shall be included
3. Hoist compatible lifting cable shall be included
4. Lifting cable holder shall be included
5. 500 lb. capacity lifting hoist and wall mount socket shall be included

D. Control Panel

A NEMA 4X panel shall include the starter and supply power and control to the submersible pump and receive fail signals from pump/motor sensors. The control panel face shall have the following: 1) run light, 2) H-O-A switch, 3) running time meter. A dry contact shall be supplied for a remote running light. This panel should be located near the pump.

2.8 PLANT CONTROLS

A. Plant Process Control Panel

Plant Process Control Panel. This panel shall utilize a NEMA type 12 enclosure with an Allen-Bradley PanelViewPlus7 12” Touch Screen Color Terminal, an Allen-Bradley CompactLogix PLC controller model number 5069-L310ER. For backup, the panel will include an Allen-Bradley model Micro 850 and a PanelView 800 4” touchscreen. This panel shall include a Secure VPN module for remote connectivity. This panel shall operate using 115-V, 15-amp service. Pneumatic solenoid valves shall be used to transmit the operational signal to the various valves in the tankage. This panel shall provide the control for the four (4) main process functions required for the AERO-MOD provided treatment equipment. This panel shall be located as shown on the plans.

1. Function 1 - RAS Timer

The timer function shall control the operation of the RAS airlift pumps in the clarifier. The control logic shall be xx minutes of operation followed by xx minutes of standby (time to be determined at time of startup). The operation shall then index to the next set of RAS banks.

An electric signal shall be sent to activate the 1/8" solenoid valves that shall be used to activate the pneumatically actuated ball valves on the clarifier RAS air supply.

2. Function 2 – SEQUOX/Digester Alternating Air Timers

These timer functions shall control the operation of the SEQUOX alternating aeration in the first and second stage aeration basins and the alternating aeration in the digester tanks. The control logic shall include timer controls of aeration valve open/close in the first aeration basin, followed by controls of aeration valve open/close in the second stage aeration basin. An overlap timer function of 5 minutes shall keep both aeration valves open during the transition. The same logic will be used for all the aeration basin stages and the digesters.

An electric signal shall be sent to activate the 1/8" solenoid valve that shall be used to activate the pneumatically actuated butterfly valves in the air headers for the first and second stage aeration basins and the digester tanks.

3. Function 3 – WAS Timer, Aeration Tank to Digester Tank

These timer functions shall control the automatic solids wasting system that shall transfer solids from the aeration basins by a WAS pump system. The control logic shall include the ability to set on which days the solids wasting will occur, and the time of day the solids wasting will occur. The timer function shall control the aeration in each of the digester tanks and the operation of an airlift pump located in one of the aeration basins. For the days that the wasting function operates, at the user-defined time(s) of day, the timer function shall close the butterfly valve in the air header for each digester and shall operate the airlift pumps, which shall pump

the WAS at a set rate to the digesters. At the end of the timer function, the WAS airlift pump shall be turned off and the aeration butterfly valves shall be opened. An electric signal shall be sent to activate the 1/8" solenoid valves that shall be used to activate the pneumatically actuated butterfly valves in the air headers for the digester tanks and the pneumatically actuated diaphragm valves on the WAS airlift pumps.

4. Function 4 – Speed Control of Aeration Blowers for D.O. Range Control

The DO₂-optimizer™ D.O. control process shall include a series of operator-established settings shall be incorporated to allow multiple adjustments in order to maintain a D.O. range within the aerated aeration basins. Timer functions shall be included that allow for blower shutdown, blower startup, and blower speed changes relative to the specified D.O. range that is set.

B. Pilot Air System

The pilot air system shall consist of an air compressor followed by an air-drying system to provide a constant, dry source of pneumatic pressure to the pneumatic control system. The contractor shall run 3/8" nylon tubing from both air compressors to the Compressed Air Alternation Panel located on the regenerative desiccant dryer/dry storage tank, and from the regenerative desiccant dryer/dry storage tank to the Plant Process Control Panel.

1. Air Compressor

An American Industrial, or equal, 3.0 HP, 460V, 3phase air compressor with an 80-gallon vertical air tank, pressure switches, and oil particulate filter shall be used to supply at least 70 psi pilot air to the pneumatic control system of the Plant Process Control Panel. Each compressor shall have an automatic drain attached to tank. For this project, **two (2)** units shall be supplied.

2. Regenerative Desiccant Dryer / Dry Storage Tank

A Tsunami Pure 10, or equal, dual tower regenerative desiccant dryer shall be furnished to keep the pilot air dry and prevent moisture buildup in the pneumatic control system. This unit shall operate using 115V, 15-amp service, and shall include a cord with plug. The dryer will be pre-mounted to a 60-gal dry air storage tank. For this project, **one (1)** unit shall be supplied.

3. Compressor Alternation Panel

One (1) compressor alternation panel shall be furnished. 460V/3ph starters for both compressors, as well as HOA selector switches shall be included within a NEMA 4 enclosure.

4. Pneumatic System Air Tubing

Pneumatic 3/8" nylon tubing (black) shall be supplied to run between the Air Compressors and the Air Alternation Panel on the Regenerative Dryer/Dry Storage

Tank, and between the Regenerative Dryer/Dry Storage Tank and the Plant Process Control Panel. Pneumatic 1/4" nylon tubing (color coded) for pneumatic control signals shall be supplied to run between the Plant Process Control Panel and actuators within the process tankage

2.9 WALL MOUNTED WALKWAYS & HANDRAIL

- A. Aluminum walkway and handrail shall be provided for installation on top of the concrete walls of the plant tankage as shown in the drawings. The walkway frame shall consist of aluminum supports and channels to be either centered or cantilevered on top of the concrete walls. The walkway shall consist of banded aluminum grating, 1" I-Bar, set into the aluminum frame. Grating on the walkway frame shall have a width of **25 inches**.
- B. All handrailing shall be two-rail system supplied with the walkway. Handrails shall be of 1-1/2" aluminum tubing with NU-RAIL aluminum handrail fittings (or equal). The handrail risers shall be securely mounted to the support frame and of proper length to place the top-rail 42" above the walkway with a mid-rail 18" below the top-rail.

2.10 ACTUATED VALVES

A. SEQUOX Air Valves

1. First Stage Aeration Basin

The equipment supplier shall supply **one (1)** 6" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include an El-O-Matic double-acting actuator that is pneumatically controlled.

The equipment supplier shall supply **one (1)** 6" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include a gear-operator for manual valve control.

2. Second Stage Aeration Basin

The equipment supplier shall supply **one (1)** 6" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include an El-O-Matic double-acting actuator that is pneumatically controlled.

The equipment supplier shall supply **one (1)** 6" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include a gear-operator for manual valve control.

B. Aerobic Digester Tank

The equipment supplier shall supply **one (1)** 4" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include an El-O-Matic double-acting actuator that is pneumatically controlled.

The equipment supplier shall supply **one (1)** 4" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include a gear-operator for manual valve control.

C. Sludge Holding Tank

The equipment supplier shall supply **one (1)** 4" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include an El-O-Matic double-acting actuator that is pneumatically controlled.

The equipment supplier shall supply **one (1)** 4" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valve shall include a gear-operator for manual valve control.

D. Constant Air Valve (Clarifier/Selector Tank/WAS Pump/Sludge Transfer Pump)

The equipment supplier shall supply **one (1)** 4" Ultraflo series 399 butterfly air valve. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. Each valve shall include a gear-operator for manual valve control.

2.11 HAND LIFT STOP PLATES

Aluminum stop plates shall be used to direct and stop flow within the tankage (future). A SS wall-mounted gate guide frame shall be used for the placement of the stop plates. A total of **two (2)** face-mounted guide frames and **one (1)** stop plate shall be supplied.

2.12 AERATION BLOWERS & CONTROLS

A. Aeration Blowers

The equipment supplier shall provide **three (3)** Kaeser ComPak model **EB421C** blower/sound enclosure packages for the aeration tanks, clarifier, digester, sludge holding tank, and selector tank. The blowers shall be installed as shown on the contract drawings. Design conditions are as follows:

1. Air Volume: 335 icfm
2. Discharge Pressure: 6.0 psig
3. Motor HP: 15 HP
4. Inlet Temperature: 104⁰ F
5. Relative Humidity: 80%
6. Elevation: 480 FASL

B. Each blower package shall include the following:

Qty.	Equipment
1	Positive displacement blower
1	V-belt drive with automatic belt tensioner
1	Inlet filter silencer with integral filter
1	Powder coated sound enclosure
1	Enclosure vent fan with 460V/60 Hz/3 phase motor
1	Vibration pads

1	Panel mounted filter restriction gauge
1	Panel mounted discharge pressure gauge
1	Panel mounted discharge temperature gauge
1	Discharge temperature switch
1	Discharge silencer
1	Flexible connector(s)
1	<i>Discharge check valve – 4”</i>
1	Pressure relief valve
1	Oil drain manifold
1	TEFC premium efficiency motor, 230V/60 Hz/3 phase
1	Motor PTC sensors
1	Ambient inlet connection

C. Aeration Blower Isolation Valve

The equipment supplier shall supply **three (3)** 3" Ultraflo series 399 butterfly air valves for blower isolation. One valve shall be used for each blower and shall be mounted in the discharge header piping. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. Each valve shall include a lever-operator for manual valve control.

D. Aeration Blower Controls

The equipment supplier shall supply a blower control panel for each blower. Each blower control panel shall include an Allen-Bradley Powerflex 753 Variable Frequency Drive (VFD) 6-pulse module and will be rated for 460V/3ph power. Each blower control panel shall be rated NEMA 12. Each panel shall include:

1. Hand/Off/Auto Functionality
2. Circuit Protection (Fused Disconnect or Circuit Breaker)
3. Fault Indication
4. Power Indication
5. VFD Running Indication
6. Run Time Metering
7. Hand Mode Speed Control
8. Drive Enable Contact
9. Drive Fault Contact

10. Constant Torque
11. Run Permissive Feature
12. 3% Line Reactor
13. Ethernet IP Module
14. Blower Enclosure Cooling Contactor w/ Overload
15. Blower Motor Thermister Relay
16. Blower Discharge Temperature Switch Monitoring

2.13 DISSOLVED OXYGEN ANALYZER MODULE & SENSOR PROBES

- A. One (1) Insite model MPA-48 multi-channel sensor analyzer modules, 110V, with sunshield, or equal.
- B. Two (2) Insite model 12 DO sensor probes, or equal.
- C. Two (2) sensor handrail mounting kits.

2.14 SPARE PARTS

The equipment manufacturer shall supply the following spare parts in a protective container for storage:

One (1) clarifier skimmer head

Two (2) clarifier skimmer head guide rod

One (1) blower maintenance kit:

- Blower oil sufficient for first change on all blowers,
- Blower inlet filter elements for first change on all blowers,
- Sets of blower belts for first change on all blowers.

One (1) Compressor maintenance kit:

- Compressor oil sufficient for the first change on both compressors,
- Compressor inlet filter elements for the first change on both compressors.

One (1) Aquamatic diaphragm actuator rebuild kit

Two (2) Prestolock union connectors

Two (2) four pole relay, 24VDC

Two (2) pilot lights of each color

Two (2) single pole relay, 24VDC

Two (2) solenoid valves

Three (3) inlet screen plug disks

2.15 WARRANTY

The equipment supplier shall warranty the Split-ClarAator clarifier equipment for a period of five (5) years from the date of start-up. Blower warranty shall be as stated by blower manufacturer. All other equipment shall have a warranty of one (1) year from date of start-up, or eighteen (18) months after ship date, whichever occurs first.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The Contractor shall install the specified *AeroMod Package WWTP* in the field as shown on the drawings and as recommended by the manufacturer. *AeroMod* equipment manufacturer shall provide installation assistance to the contractor, inspection after installation and start-up services, which may require multiple trips.
- B. Equipment shall be installed in accordance with the manufacturer's shop drawing and written installation instructions.

3.2 FIELD TESTING AND STARTUP

- A. Installation Inspection. Manufacturer's representative shall provide a written certification that the installed equipment has been properly installed and aligned according to manufacturer's installation criteria, and the *AeroMod Package WWTP* is ready for testing in full-load operating conditions. Field inspection shall be performed by manufacturer's representative for verification of complete installation including all electrical requirements, instrumentation, and control systems. Submit Inspection Certificate to the Construction Manager. Contractor shall not perform testing of the equipment and control system without Inspection Certification approved by the Owner's representative/ engineer.
- B. Functional Test. Contractor shall conduct performance testing on each treatment unit in the presence of the Owner's representative to demonstrate all functions of the equipment in full-load operating conditions for a minimum of seven (7) consecutive days during each phase of the approval process. Contractor shall submit a completion report to certify that the installed *AeroMod Package WWTP* meets the specified performance requirements.
- C. 7-Day Performance Test. The test shall consist of running the equipment under the specified operating conditions for seven consecutive days in fully automatic without failure to qualify as acceptable. If there is a failure the problem must be identified, corrected, and approved by the Owner's representative before the test can be rescheduled. "Failure" is considered any problem that requires correction by maintenance personal, such as instrumentation and control failure or alarm, any motor alarm, power failure, phase failure, communication failure, PLC failure or UPS failure.
- D. Only after completion of 7-day test and submittal requirements, the Owner's representative can then accept the equipment.

3.3 EQUIPMENT OPERATOR TRAINING

The manufacturer shall provide two (2) days of on-site equipment inspection and equipment

start-up/training upon complete installation of equipment. A check-off sheet shall be completed and signed by the contractor prior to dry equipment inspection.

The manufacturer shall provide one (1) additional day for on-site equipment and process training after successful start-up of the plant.

The manufacturer shall provide two (2) days of operator school at the manufacturer's home office for two (2) operators after the treatment plant is operational. The operator school shall provide 10 hours to the attending operator, as recognized by the State of Kansas.

END OF SPECIFICATION SECTION

(NO TEXT FOR THIS PAGE)

SECTION 46 66 56**ULTRAVIOLET (UV) DISINFECTION EQUIPMENT****PART 1 GENERAL****1.1 SCOPE OF WORK****A. Scope:**

Furnish all labor, materials, equipment, and appurtenances required to provide an open channel gravity flow ultraviolet (UV) disinfection system at the Wheatland Wastewater Treatment Plant. The UV system shall be installed complete and operational with all control equipment and accessories as shown and specified.

B. Related Work (Specified Elsewhere):

1. Specification Sections 25 00 00 - Instrumentation and Controls.
2. Specification Sections 26 00 00 - Electrical

1.2 MEASUREMENT AND PAYMENT

- A. Include all costs in the applicable bid items with price breakdown included in the Schedule of Values.
- B. Refer to Section 01 29 00 – Measurement and Payment Procedures

1.3 QUALITY ASSURANCE

- A. Pre-qualification Requirements: Any UV manufacturer that is not named or listed as the approved base bid manufacturer must submit the following pre-qualification submittals from manufacturers 15 days prior to bid to be considered for or equal:
 1. The UV manufacturer shall be regularly engaged in the manufacture of UV equipment with a proven track of record of at least one thousand (1,000) municipal installations in North America. The manufacturer will provide documentation of previous experience with municipal UV disinfection systems in wastewater applications with electronic ballasts.
 2. Pre-qualification submittals from manufacturers will include a complete and detailed proposal of equipment offered, including the number of lamps proposed and a detailed description of any exceptions taken to the specification.
 3. The UV manufacturer will submit a bioassay evaluation for the proposed reactor. This bioassay will have been validated by an independent third party and have followed protocols described in the US EPA Design Manual – Municipal Wastewater

Disinfection (EPA/625/1-86/021), without exception. The manufacturer's bioassay report must demonstrate that the proposed UV system design and number of lamps will deliver the specified dose.

4. Documentation of UV manufacturer's service capabilities including location and experience.
 5. Sample disinfection performance guarantee including scope and duration of guarantee- minimum of 5 years required.
- B. Performance Requirements:
1. The UV system shall be designed to deliver a minimum UV dose of 30,000 $\mu\text{Ws}/\text{cm}^2$ (mJ/cm^2), in effluent with a UV Transmission of 65 % after reductions for quartz sleeve absorption, sleeve fouling, and lamp aging. The basis for evaluating the UV dose delivered by the UV system will be the manufacturer's bioassay as carried out by an independent third party. Bioassay validation methodology to follow protocols described in US EPA Design Manual - Municipal Wastewater Disinfection (EPA/625/1-86/021), without exception.
 2. The UV system will produce an effluent conforming to the following discharge permit: 125 E.Coli/100 ml, based on a 30 Geometric Mean. Grab samples will be taken in accordance with the Microbiology Sampling Techniques found in Standard Methods for the Examination of Water and Wastewater, 19th Ed.
- C. Factory Testing: The UV modules, mechanical and electrical shall be factory assembled and tested for performance prior to delivery. Testing shall take place at the UV manufacturer's fabrication facility. The UV Control Panel should be UL listed in the factory prior to shipment.
- D. Acceptance Test. The UV manufacturer shall submit a test protocol for the UV system start up and performance testing to the engineer a minimum of 10 days prior to initial testing and start-up. The installing contractor shall notify the Owner and UV manufacturer, in writing, that he is prepared to begin the acceptance test. The Owner shall then provide written notification to the Contractor to proceed with the acceptance testing. Results of the test done by the contractor will be supplied for review to the Owner and UV manufacturer.

1.4 STANDARD REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Institute of Electrical and Electronic Engineers (IEEE)
- D. National Electric Code (NEC)

- E. National Electrical Manufacturers Association (NEMA)
- F. Underwriters' Laboratories (UL)

1.5 SUBMITTALS

- A. Shop Drawings: Submit for review shop drawings showing the following:
 - 1. Complete description in sufficient detail to permit an item comparison with the specification including experience documentation.
 - 2. Major component dimensions, layouts, and installation requirements.
 - 3. Descriptive information including manufacturer's catalogue brochures and specifications for UV system.
 - 4. Electrical schematics and control panel wiring diagrams.
 - 5. Independent bioassay report demonstrating dose delivered under design conditions.
 - 6. Factory Certificate for UV system performance test
 - 7. Spare parts list.
- B. Furnish Operation & Maintenance (O&M) Manuals per Section 01 78 23. Prepare them specifically for this installation, and include all required section drawings, equipment parts lists, name of protective coatings, recommended spare parts, descriptions, etc, that are required to instruct operating and maintenance personnel unfamiliar with this equipment. Include all approved Shop Drawings in the Operation and Maintenance Manuals.
- C. Final O&M Manual Submittal. Provide three (3) copies of Final O&M Manuals bounded in D-ring binders for final acceptance of the installed system. The Final O&M Manuals shall include approved product data and As-Built Shop Drawings with field modifications and/or corrections, and manufacturer's certifications including installation inspection, testing and startup completion reports. All the Final O&M Manual files shall include electronic copies of the O&M manuals in portable document files (PDF) on a computer disc (CD or DVD) attached to each Final O&M Manual submittal.

1.6 Delivery and Storage

- A. Ship as few parts as possible, requiring minimum onsite assembly. Coordinate with Contractor for equipment delivery and storage at jobsite.
- B. Provide lifting eyes or lugs to allow easy installation of the unit into the effluent channel.
- C. All equipment delivered to site shall be protected from any damages under provisions of Section 01 60 00 – Basic Product Requirement.

1.7 GUARANTEE

A. Equipment:

The equipment furnished under this section will be free of defects in material and workmanship, including damages that may be incurred during shipping for a period of 12 months after substantial completion and performance testing at the jobsite.

B. UV Lamps:

The UV lamps to be warranted for a minimum of 12,000 hours (non-prorated) or thirty-six (36) calendar months from shipment, whichever comes first. Pro-rated lamp warranties will not be accepted. On / off cycles are limited to an average of four (4) per day without exception.

2.0 PRODUCTS

2.1 EQUIPMENT MANUFACTURER, MODEL

A. Manufacturer: Trojan Technologies, of London, Ontario, Canada.

B. Model: Trojan 3200K PTP

2.2 GENERAL REQUIREMENTS

A. Provide a UV disinfection system complete with influent channel with flange connection, UV lamp modules, effluent channel with flange connection, level control weir, power distribution modules and UV monitoring control panel as shown on the Contract Drawings and as herein specified.

B. UV system will be designed for complete outdoor installation, without shelter or supplemental cooling or heating required.

2.3 DESIGN, CONSTRUCTION AND MATERIALS

A. General:

1. All material in contact with effluent will be stainless steel or quartz.
2. All material exposed to UV light will be stainless steel, anodized aluminum, quartz 214, or Teflon™.

B. Design Criteria:

1. Provide a UV system designed for disinfecting secondary effluent from a wastewater plant with the following characteristics:
 - a. Design Capacity: 280,000 GPD

- b. Total Suspended Solids: 30 mg/L on a 30-day average
 - c. Ultraviolet Transmittance @ 253.7 nm: 65 %
 - d. Annual Effluent Temperature Range: 33 to 85 °F or 0 to 29 °C
 - e. Effluent standard to be guaranteed: 125 / 100 ml e.coli based on 30-day Geometric Mean of consecutive daily grab samples
- 2. The UV equipment will be installed in a stainless-steel channel furnished as part of this system, and having dimensions as shown on the drawings.
 - 3. The system supplied will be arranged in the following manner.
 - a. Number of Lamps in each UV Lamp Module: two (2)
 - b. Number of UV Lamp Modules: four (4)
 - c. Number of UV Banks: one (1)
 - 4. The lamp array configuration will be evenly spaced in both horizontal and vertical rows with all lamps parallel to each other and to the effluent flow.

C. UV Module (UVM):

- 1. Each UV lamp module will consist of two lamps and their corresponding electronic ballast. Each lamp will be enclosed in its individual quartz sleeve, one end of which will be closed, and the other end sealed by a lamp end seal and holder.
- 2. The electrical wires connecting the lamps to the electronic ballasts will be enclosed in the stainless-steel frame. Systems where lamp wiring is submerged in the effluent and exposed to UV light will not be allowed.
- 3. Each UV module will be provided with a standard 120 Volt plug and weatherproof cable for connection to a receptacle. The cable will be 10 feet (3.0 m) long. A total of four (4) UV lamp modules will be supplied. Lamp status will be displayed on top of each UV module using watertight LED indicator lights.
- 4. Modules will be approximately 68.2 inches long, 14.16 inches high and 2.8 inches wide, weighing approximately 30 lbs . Materials of construction will be stainless steel type 316, anodized aluminum, quartz 214, and Teflon™, with UL rating of Type 6P

D. UV Lamps:

- 1. UV system will use low pressure mercury slimline lamps of the hot cathode, instant start design.
- 2. 90% of UV output will be within the wavelengths of 233.7 to 273.7 nm.
- 3. The operating life of the lamp shall be guaranteed for 12,000 hours, non-pro-rated.
- 4. Independent validation of lamps aging factor is required.

E. Lamp End Seal and Lamp Holder:

1. The open end of the lamp sleeve will be sealed by means of a sleeve nut which threads onto a sleeve cup and compresses the sleeve 'O' ring.
2. The sleeve nut will have a knurled surface to allow a positive handgrip for tightening. The sleeve nut will not require any tools for removal.

F. UV Lamp Sleeves:

1. Quartz sleeves to be Type 214 clear fused quartz circular tubing as manufactured by General Electric or equal.
2. Quartz to be rated for UV transmission of 89% and not subject to solarization.
3. The nominal wall thickness will be 1.0 to 2.0 mm to maximize UV transmission.

G. Effluent Channel:

1. Each UV unit will be provided with one (1) effluent channel complete with drain (if concrete provided by other if stainless steel by UV manufacturer), UV module support rack and downstream level control weir.
2. Each effluent channel will have the following inside dimensions: Length 96 inches, width 12 inches, and height 17.08 inches if channel is stainless steel.

H. Level Control Weir:

1. Weir will be located downstream of the UV modules to maintain an average water depth of 6 inches and ensure lamp submergence at all times.
2. Maximum effluent level variance from zero to peak flow will not exceed 1.5 inches.
3. Weir will be welded watertight and include a drain port and valve.

I. Electrical:

1. The UV disinfection system will be divided into four UV modules.
2. Interconnecting Cables to be standard 120 Volt, weatherproof, 10 feet (3.0 m) long and will be suitable for outdoor installation.
3. Power Distribution Receptacles:
 - a. 120 Volt receptacles rated for continuous outdoor use will be provided. Receptacles will be of the duplex type complete with ground fault interrupter circuitry.
 - b. Receptacles to be provided by the UV Manufacturer.
4. Power Consumption:
 - a. Maximum power draw to UV System will be 700 watts.
 - b. All electrical supplies will be 120 Volt, 60 Hz or 230 Volt, 50/60 Hz

- c. A separate 120-volt, 5-amp supply to be provided for the Monitoring System.
5. Surge Protection:
UV system electrical shall include surge protection devices as recommended by the UV equipment manufacturer.
- J. Cleaning Procedure:
 1. The UV lamp modules will be cleaned by removing from the effluent channel and hand wiping the sleeves with an acid solution, using a non-abrasive cloth.
- K. Monitoring System:
 1. One (1) submersible UV sensor(s) will continuously monitor the UV intensity produced in the bank of UV lamp modules. The sensor will measure the germicidal portion of the light emitted by the UV lamps.
 2. UV intensity will be indicated on a 3 character display in mW/cm².
 3. Elapsed time in hours (lamp age) will be indicated on a 5 character display.
 4. Both displays will utilize LEDs and will be visible through the panel door.
 5. A dry contact will be provided for remote indication of Low UV intensity alarm.
 6. Monitoring System will be enclosed in a fiberglass Type 4X wall mounted panel and is to be located less than twelve (12) feet (3.66 m) from the LED end of the UV Module.
- L. Power Distribution Receptacle (PDR):
 1. Duplex ground fault interrupter receptacle(s) will be provided by the UV Manufacturer.
 2. Receptacles will be mounted in an individual, impact resistant thermoplastic junction box complete with a Type 3R rain shield for outdoor installation.
- M. Transition Connections:
 1. One inlet and one outlet transition box(es) will be supplied.
 2. The material of construction for the transition boxes will be stainless steel type 304, 14 gauge.
 3. Openings on the transition boxes (for flange connections) conform to ANSI standards and have dimensions as shown on the Contract Drawings.
- N. Ultraviolet Intensity and Lamp Failure Alarm Circuit
 1. An analog output, 4 – 20mA, must be provided for remote indication of UV intensity condition.
 2. A set of dry contacts must be provided for remote indication of an UV lamp failure condition.

O. Ultraviolet Lamp Monitoring

1. A logic circuit shall be provided which monitors the operating condition of each individual UV lamp and provides dry contacts for remote notification in the event of a lamp failure. This logic circuit shall be low voltage <25 volts.
2. An indication labeled "lamp out", located at the UV control panel shall be generated in the event of a UV lamp failure. The information describing the UV lamp(s) operation shall be displayed at the top of each UV Lamp modules.
3. In the event of a UV system failure, the UV monitor must send an alarm signal (contact) for remote alarm notification.
4. Provide both resettable and non-resettable (to 99,999 hours) elapsed time indication for each bank of a UV module.
5. The UV system shall continuously monitor the status of UV output intensity, and the age of each bank of UV lamp in hours. These UV output intensity should be displayed at a remote location over the plant's Local Area Network.

P. Maintenance Rack:

1. One (1) Type 304 stainless steel maintenance rack(s) will be supplied. The rack is designed to hold UV modules during service or maintenance.

Q. Spare Parts:

1. The following additional parts will be furnished:
2. Four (4) UV Lamps
3. Four (4) Lamp Sleeves
4. Four (4) Lamp Holders
5. One (1) Operators Kit (including 1 face shield, gloves)

3.0 EXECUTION

- A. An Independent third-party bioassay based on the installed UV system arrangement and specific to the equipment being supplied shall be provided.

3.1 INSTALLATION

- A. The Contractor shall install the specified Ultraviolet Disinfection system in the disinfection channels, or on a concrete slab above grade as shown on the drawings and as recommended by the UV manufacturer. UV equipment manufacturer shall provide consultation assistance for installation assistance to the contractor, inspection, and start-up services in multiple trips.

- B. Equipment shall be installed in accordance with the manufacturer's shop drawing and written installation instructions. Contractor shall not start up the UV equipment and control system without Inspection Certification approved by the UV manufacturer's representative.
- C. Installation Inspection. Manufacturer's representative shall provide a written certification that the installed UV equipment has been properly installed and aligned according to manufacturer's installation criteria, and the *UV systems* are ready for testing in full-load operating conditions. Field inspection shall be performed by manufacturer's representative for verification of complete installation including all electrical requirements, instrumentation and control systems. Submit Inspection Certificate to the Construction Manager. Contractor shall not perform functional testing of the UV equipment and control system without Inspection Certification approved by the UV manufacturer's representative.

3.2 MANUFACTURER'S REPRESENTATIVE'S SERVICES

- A. The UV supplier shall submit a formal test protocol for engineer's approval for use during performance tests. UV equipment manufacturer shall provide the following field services after the equipment is installed complete at the jobsite; travel time excluded:
 - 1. UV supplier shall provide field services for installation inspection, functional and performance testing of the UV modules and control functions, adjustment as needed and certification of installation.
 - 2. UV supplier shall provide a 4-hour training session of the UV disinfection systems operation, maintenance, and control functions.
 - 3. Follow-up Inspection Services. One month from the completion of the initial operation and maintenance instruction, a factory-trained representative of the UV equipment manufacturer shall return to the job site for a 4-hour follow-up inspection and system adjustment and optimization.

3.04 FIELD TESTING AND STARTUP

- A. Functional Test. Contractor shall conduct performance testing on each unit in the presence of the Owner's representative to demonstrate all functions of the equipment in full-load operating conditions for a minimum of seven (7) consecutive days during each phase of the approval process. Contractor shall submit a completion report to certify that the installed *UV system* meets the specified performance requirements.
- B. 7-Day Test Period. The 7-Day test shall consist of running the equipment under the specified operating conditions for seven consecutive days in fully automatic without failure to qualify as acceptable. If there is a failure the problem must be identified, corrected, and approved by the Owner's representative before the test can be rescheduled. "Failure" is considered any problem that requires correction by maintenance technician,

such as instrumentation and control failure or alarm, any motor alarm, power failure, phase failure, communication failure, PLC failure or UPS failure.

- C. Only after completion of 7-day test and submittal requirements, the Owner's representative can then accept the equipment.

End of Specification

APPENDIX A: GEOTECHNICAL REPORT



GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED WASTEWATER TREATMENT PLANT AND GRAVITY SEWER SYSTEM
WHEATLAND, INDIANA

ATLAS PROJECT NO. 170GC01517

JANUARY 6, 2023

PREPARED FOR:

WHEATLAND WATER UTILITY DEPARTMENT
C/O RQAW CORPORATION
8770 NORTH STREET
FISHERS, IN 46038

ATTENTION: MR. AARON CROW, P.E.
WATER/WASTEWATER PROJECT MANAGER



January 6, 2023

Wheatland Water Utility Department
c/o Mr. Aaron Crow, P.E.
Water/Wastewater Project Manager
RQAW Corporation
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Fishers, IN 46038

ATLAS Technical
Consultants LLC

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Re: **Geotechnical Engineering Investigation**
Proposed Wastewater Treatment Plant and Gravity Sewer System
Wheatland, Indiana
Atlas Project No. 170GC01517

Dear Mr. Crow:

Submitted herewith is the report of the geotechnical engineering investigation performed by Atlas Technical Consultants LLC (Atlas) for the referenced project. This study was authorized in accordance with Atlas Proposal-Agreement No. 22-11727 dated September 15, 2022.

This report contains the results of the field and laboratory testing program, an engineering interpretation of this data with respect to the available project characteristics and recommendations to aid design and construction of the earth-connected phases of this project. We wish to remind you that we will store the samples for 30 days after which time they will be discarded unless you request otherwise.

We appreciate the opportunity to be of service to you on this project. If we can be of any further assistance, or if you have any questions regarding this report, please do not hesitate to contact either of the undersigned.

Sincerely,

A handwritten signature in blue ink that reads "Daniel Homm".

Daniel Homm, P.E.
Senior Project Engineer



A handwritten signature in blue ink that reads "David McIlwaine".

David Mcilwaine, P.E.
Senior Project Engineer

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Appendix

1 PURPOSE AND SCOPE

The purpose of this study was to determine the general subsurface conditions at the project site by drilling 32 test borings specifically for this project and to evaluate this data with respect to design and construction of the proposed wastewater treatment plant and gravity sewer system. In addition to the 32 soil test borings that were drilled specifically for this project, this study also includes data from 12 test borings that were drilled in the near vicinity of the proposed project site. Also included is an evaluation of the site with respect to potential construction problems and recommendations dealing with quality control during construction.

2 PROJECT CHARACTERISTICS

RQAW is assisting the Town of Wheatland in developing plans for a new wastewater treatment plant and the installation of a new gravity sewer system in Wheatland, Indiana. The general location of the project site is shown on the Vicinity Map (Figure 1 in the Appendix). The new 47,000 gallon/day wastewater treatment plant will be located at the east terminus of East Main Street and will include a lift station, an aerator/digester/sludge holding tank (Aeromod tanks), a covered sludge drying bed and multiple other features. It is our understanding that all of the structures will be above-grade except for the lift station, which will bear about 25 ft below the existing grade. Other proposed water system improvements include installing new sludge piping, drying bed drain lines, a UV disinfection chamber and a step aeration structure.

The project will also include a new gravity sewer system throughout the entire town. It is our understanding that the proposed sewers will typically be installed at depths ranging from as shallow as about 5 ft to as deep as about 30 ft below the existing ground surface and consist of PVC piping with a diameter of 8 inches. The approximate test boring locations, proposed wastewater treatment plant facilities and existing site conditions are shown on the Boring Plans (Figures 2 and 3 in the Appendix).

Details regarding structural loads are not available at this time; however, for the purpose of this study it has been assumed that the maximum column, wall and floor loads for the proposed structures will not exceed about 200 kips/column, 5 kips/lin.ft and 200 lbs/sq.ft, respectively. No unusual loading conditions or settlement restrictions have been specified.

3 GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions were investigated by drilling 32 test borings for this investigation (Borings B-101 through B-132) in addition to 12 test borings that were drilled previously. The test borings were drilled to depths of 15 ft to 40 ft below the existing ground surface. The test borings were performed at the approximate locations shown on the Boring Plans (Figures 2 and 3 in the Appendix). In addition to the 32 test borings that were drilled specifically for this project, this study also includes 12 soil test borings that were drilled in the near vicinity of the project site (Borings B-1 through B-12 for Atlas Project No. 170GC01308).

The subsurface conditions disclosed by the field investigation are summarized in the following paragraphs. Detailed descriptions of the subsurface conditions encountered in the test borings are presented on the "Test Boring Logs" in the Appendix. The letters in parentheses following the soil descriptions are the soil classifications in general accordance with the Unified Soil Classification System (ASTM D2488). It should be noted that the stratification lines shown on the test boring logs represent approximate transitions between material types. In-situ stratum changes could occur gradually or at different depths.

3.1 Subsurface Soil and Bedrock Conditions

Most of the test borings were drilled in the existing streets and revealed approximately 5 inches to 12 inches of asphalt pavement, with some also encountering aggregate base with thicknesses ranging from 8 inches to 10 inches. Borings B-118 and B-119 revealed 4 inches and 6 inches of brick, respectively, below the overlying asphalt. Borings B-127 and B-128 encountered 12 inches and 5 inches, respectively, of cinders underlying the asphalt pavement. Borings B-101, B-102, B-103 and B-104 were drilled in a grass area near the east boundary of the town, in the area of the proposed wastewater treatment plant and encountered topsoil with thicknesses ranging from 4 inches to 6 inches.

Underlying the pavement most of the test borings revealed silty clay fill materials containing various amounts of sand and gravel to a depth of approximately 3.5 ft below the existing ground surface. These soils were identified as fill material due to the unusual color, texture and stratification of the soil samples. Borings B-113, B-116 and B-127 revealed trace cinders and/or brick fragments within the silty clay fill soil.

Underlying the surficial materials and/or fill, the test borings typically revealed moderate to high plasticity, soft to medium stiff cohesive soils consisting primarily of silty clay (CL) that contains varying small amounts of sand in some cases. Layers of clayey silt (ML) and/or higher plasticity clay (CH) were also encountered in some of the test borings interbedded within the silty clay soils. Also interbedded within the cohesive layers at varying depths were granular soil seams/layers consisting of loose to dense silty sand (SM), sand (SP-SM) and/or clayey sand (SC). Underlying these soils, weathered shale and sandstone bedrock was encountered in about half of the test borings at depths ranging from about 13 ft to 21 ft below the existing ground surface.

As described above, some of the test borings drilled for this project revealed weathered bedrock and Borings B-107, B-114, B-121, B-125, B-126 were drilled to auger refusal. Auger refusal is defined herein as the depth at which a conventional test drill rig cannot advance the hollow-stem-augers such as those used for this subsurface investigation. It is important to understand that auger refusal is not necessarily coincident with the bedrock surface since the augers can penetrate the upper weathered or fractured bedrock in most cases. The following table summarizes the depths and elevations at which the top of bedrock was encountered in the test borings drilled for this investigation.

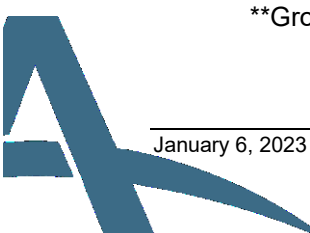
Table No. 1 – Estimated Depths and Elevations of Auger Refusal

Boring No.	Ground Surface Elevation*	Top of Bedrock Depth, ft	Estimated Top of Bedrock Elevation, ft*	Estimated Bottom of Test Boring Elevation*
B-101	479	NA	NA	439
B-102	480	NA	NA	460
B-103	479	NA	NA	454
B-104	479	NA	NA	459
B-105	486	NA	NA	466
B-106	484	NA	NA	464
B-107	493	16.0	477	469
B-108	482	NA	NA	462
B-109	488	NA	NA	473
B-110	479	NA	NA	454
B-111	485	18.0	467	450
B-112	480	NA	NA	465
B-113	483	20.5	463	458
B-114	478	21.0	457	454
B-115	479	NA	NA	459
B-116	479	NA	NA	464
B-117	477	NA	NA	462
B-118	492	NA	NA	477
B-119	491	NA	NA	471
B-120	507	16.0	491	477
B-121	512	13.0	499	486
B-122	509	15.5	494	490
B-123	507	NA	NA	487
B-124	518	13.0	505	503
B-125	515	16.0	499	476
B-126	501	15.5	486	470
B-127	490	18.0	472	470
B-128	489	20.5	469	455
B-129	486	NA	NA	461
B-130	489	NA	NA	474
B-131	486	NA	NA	451
B-132	479	NA	NA	444
B-1	495**	NA	NA	480
B-2	501**	NA	NA	486
B-3	500**	NA	NA	490
B-4	490**	NA	NA	475
B-5	521**	NA	NA	506
B-6	494**	NA	NA	479
B-7	508**	NA	NA	493
B-8	485**	NA	NA	470
B-9	484**	NA	NA	469
B-10	486**	NA	NA	NA
B-11	483**	NA	NA	473
B-12	490**	13.5	477	475

NA – Bedrock not encountered in test boring.

*Ground surface elevation estimated from plans provided by RQAW.

**Ground surface elevation estimated from Google Earth.



The qualitative strengths or consistencies of the cohesive soils and the qualitative densities of the granular soils as described above and on the test boring logs were estimated based on the results of the standard penetration test (ASTM D1586) and based on the definitions as described on the Field Classification System for Soil Exploration contained in the Appendix of this report.

3.2 Ground Water

Ground water observations were made during the drilling operations by noting the depth of free ground water (if any) on the drilling tools and in the open boreholes (if any) immediately after withdrawal of the drilling augers. Free ground water was noted at depths varying from about 11 ft to 22 ft below the existing ground surface in about half of the test borings while no free ground water was noted in the other test borings.

It must be noted that short-term ground water level observations made in cohesive soils are not necessarily a reliable indication of the current ground water level or future ground water levels. Therefore, ground water may be encountered at varying depths and locations across the site and fluctuations in the level of the ground water should be expected due to variations in rainfall and other factors not evident at the time of the field investigation. It is also possible that “perched” ground water may be encountered at various depths and locations across the site and water is often trapped within old miscellaneous fill materials, abandoned utilities, utility trenches, etc. and although the amount of such water is usually not significant, it is important to recognize that such ground water may be encountered at various depths and locations.

4 DESIGN RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described project characteristics (Section 2) and subsurface conditions (Section 3). If there are any changes in the project criteria, including the proposed lift station location, bearing elevation, sewer alignment, invert elevations, etc., a review should be made by this office.

The design recommendations presented herein are based on the assumption that all earth related elements of the project will be carefully and continuously observed, tested and evaluated by a geotechnical engineer or qualified geotechnical technician working under the direction of a geotechnical engineer to confirm that the earth related elements of the project are compatible and consistent with the conditions upon which the design recommendations are based. The careful and thorough field testing and observations of the soil related aspects of the project are a critical and essential component of the design recommendations.

4.1 Seismic Parameters

Based on geologic mapping and the results of the test borings, it is our opinion that the subsurface conditions at this site meet the criteria for Site Class D based on Section 1613.3.2 of the 2012 International Building Code (Chapter 20 of ASCE 7-10 “Minimum Design Loads for Buildings and Other Structures”). The recommended seismic design parameters are summarized in the following table:

Table No. 2 - Recommended Seismic Design Parameters

Seismic Design Parameter	Recommended Class/Value
Seismic Site Class*	D
Site Modified Peak Ground Acceleration, PGA_M	0.30g
Design Spectral Response Acceleration at Short Periods, S_{DS}^{**}	0.40g
Design Spectral Response Acceleration at 1-Second Period, S_{D1}^{**}	0.22g

*Based upon Chapter 20 of ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures"

**Based upon Section 1613 of the 2012 International Building Code

4.2 Wastewater Treatment Plant Structure Foundations

The results of the subsurface investigation indicates that the proposed structures can be supported on mat foundations and/or conventional spread footings provided that any uncontrolled fill and any zones of softer and/or looser natural soils are first removed and replaced with engineered fill at the mat foundation and spread footing locations. Mat foundations that bear at or below El 477 on firm natural soil, or on well-compacted engineered fill that is placed over firm natural soil after first removing any unsuitable materials, can be designed for a maximum allowable soil bearing pressure of 2,000 lbs/sq.ft. A modulus of subgrade reaction value of 15 lbs/cu.in. can be used for the structural design of the mat foundations in this case. Conventional spread footings that bear on firm natural soil at or below El 477 can be designed for an allowable soil bearing pressure of 2,000 lbs/sq.ft for both column (square type) and wall (strip type) footings. The net allowable soil bearing pressures can be increased by a factor of 1.33 for extreme or transient loading conditions such as wind gusts and earthquake loads.

It is extremely important that the soil at the base of each mat foundation and spread footing excavation be carefully observed and evaluated as described in Section 5.2 so that any unsuitable materials (such as any uncontrolled fill, softer/looser natural soils, etc.) can be identified, removed and replaced and to verify that the mat foundations and spread footings will bear on suitable materials. Based on the results of the test borings, it is expected that undercutting of at least softer/looser natural soils, and possibly old uncontrolled fill, will be required at some locations. It is recommended that the contract documents include provisions for the removal and replacement of unsuitable materials as determined to be necessary based on field observations at the time of construction. The careful and thorough field testing and observations of the soils at the bases of the foundation excavations are a critical and essential component of the foundation design.

4.3 Mat Foundation – Lift Station

The results of the subsurface investigation indicate that the proposed lift station structure can be supported on a base mat foundation bearing approximately 17 ft, or deeper, below the existing ground surface. A mat foundation that bears on firm natural soil at or below about El 462, at least about 17 ft below the existing ground surface, can be designed for a maximum allowable gross soil bearing pressure of 3,500 lbs/sq.ft. A modulus of subgrade reaction value of 25 lbs/cu.in. can be used for the structural design of the mat foundation in this case.

It is important that the soil at the base of the mat foundation be carefully observed and evaluated as described in Section 5.3 so that any unsuitable materials can be identified, removed and replaced and to verify that the foundation will bear on suitable materials. The careful and thorough field testing and observations of the soils at the base of the foundation excavation are a critical and essential component of the foundation design. Where undercutting is required to remove unsuitable materials, the proposed foundation elevation may be re-established by backfilling with lean concrete after all undesirable materials have been removed.

4.4 General Foundation Recommendations

In using net pressure, the weight of the footing and backfill over the footing including the weight of the floor slab need not be considered; hence, only loads applied at or above the finished floor need to be used for dimensioning the footings. Wall footings should be at least 2 ft wide and column footings should be at least 3 ft wide for bearing capacity considerations.

All exterior footings and footings in unheated areas should be located at a depth of at least 2.5 ft below the final exterior grade for frost protection. Although the Indiana Building Code requires only 2 ft of foundation embedment below the exterior grade in Knox County, our experience indicates that the actual frost depths in this region can occur deeper. Interior footings can be located at nominal depths below the finished floor provided all undesirable materials (i.e., softer natural soils, fill materials, etc.) are removed at the footing locations.

Provided that the footings are designed as prescribed herein and the footing excavations are evaluated as outlined in Section 5.3, it is estimated that the total and differential foundation settlements should not exceed about 1 in. and $\frac{3}{4}$ in., respectively. Careful field control will contribute substantially to minimizing the settlements.

Care must be exercised when excavating near any existing structures, utilities, etc. that will remain to protect the integrity of the existing features. Bracing or underpinning will be required where it is necessary to excavate below the bottom elevation of the existing features.

Uplift forces on the spread footings can be resisted by the weight of the footings and the soil material that is placed over the footings. It is recommended that the soil weight considered to resist uplift loads be limited to that immediately above and within the perimeter of the footings unless a much higher factor of safety is used. A total soil unit weight of 110 lbs/cu.ft can be used for the backfill material placed above the footings, provided it is compacted as recommended in Section 5.2. It is also recommended that a factor of safety of at least 1.3 be used for calculating uplift resistance from the footings, provided only the weight of the footing and the soil immediately above it are used to resist uplift forces.

Lateral loads imparted upon shallow spread footings can be resisted by the passive lateral earth pressure against the sides of the footings and by friction between the foundation soil and the bases of the footings. If passive lateral earth pressure is to be used to resist lateral loads imparted on the spread footings, it is essential that the soil that is relied upon to provide the passive lateral earth pressure resistance cannot be excavated or otherwise disturbed at any time in the future. If it is possible that disturbance or an excavation could be made in any portion of the passive zone (including not only soils immediately beside the spread footings but also the soils that exist above the top of the footing elevation since the passive resistance is dependent upon the weight of the overburden soils), then passive lateral earth pressure resistance should not be considered for resistance of lateral loads. Since significant displacement is required to mobilize passive resistance, a factor of safety of 3 has been used to determine the allowable equivalent fluid pressure for the passive condition in order to minimize the potential for excessive displacement. Based upon the soils encountered at this site, an allowable passive lateral earth pressure (allowable "equivalent fluid pressure") of 125 lbs/sq.ft per foot of depth below the ground surface can be used for that portion of the footing that is below a depth of 2.5 ft below the final exterior grade, or 2.0 ft below the interior floor slab (no portion of the footing above these depths should be used for lateral resistance). An allowable coefficient of friction between the base of the footing and the underlying soil of 0.2 (based on a factor of safety of 1.5) can be used in conjunction with the minimum downward load on the base of the footing.

4.5 Slab-on-Grade Floors

Slab-on-grade floors can be supported on firm natural soils or on new compacted structural fill. It is furthermore recommended that the slab-on-grade floors be supported on a 6 in. thick layer of relatively clean granular material such as sand and gravel or crushed stone. This is to help distribute concentrated loads and equalize moisture conditions beneath the slab. Provided that a minimum of 6 in. of granular material is placed below the slab, a modulus of subgrade reaction (k_{30}) of 110 lbs/cu.in. can be used for design of the floor slabs.

4.6 Lift Station Walls, Ground Water and Uplift Resistance

The magnitude of the lateral earth pressure against the lift station walls is dependent on the method of backfill placement, the type of backfill material used, drainage provisions and whether or not the walls are permitted to yield during and/or after placement of the backfill. When a wall is held rigidly against horizontal movement, such as walls that are braced by the other walls (which is the case for the lift station structure), the lateral earth pressure against the walls is greater than the "active" lateral earth pressure that is typically used in the design of free-standing retaining walls that are free to rotate sufficiently to develop the "active" lateral earth pressure condition. Therefore, since the lift station walls will be braced and will not be free to rotate to develop the active lateral earth pressure condition, the walls should be designed for "at-rest" lateral earth pressures using an at-rest lateral earth pressure coefficient, K_0 . A design illustration to aid in computing lateral earth pressures against the below-grade lift station walls is included as Figure 4 in the Appendix.

It is recommended that only well-graded granular material should be used for backfill behind the below-grade walls within a zone defined by a plane extending upward and outward on a 1 to 1 slope from the base of the wall as shown in Figure 4. Provided that well-graded granular materials are used for backfill behind the below-grade walls, a coefficient of lateral earth pressure at-rest (K_o) of 0.45 can be used to calculate the at-rest lateral earth pressure against the below-grade lift station walls, with an at-rest lateral earth pressure value of 0.55 for cohesive soils, using Figure 4 in the Appendix.

It is assumed that the proposed below-grade lift station structure will be made watertight and designed to resist buoyancy (uplift) and full hydrostatic pressures. Figure 4 in the Appendix, which includes hydrostatic pressures as well as lateral earth pressures, can be used for the design of the below-grade walls in this case. Figure 4 includes pressures due to surcharge loads at the ground surface, lateral earth pressures and hydrostatic pressure acting on the below-grade walls. A minimum area surcharge loading of 250 lbs/sq.ft should be included for design of the walls to account for the surcharge from the future maintenance equipment that may be necessary around the structure. In using Figure 4 in the Appendix to determine the pressures acting upon the below-grade lift station walls, it is recommended that the total soil unit weight (γ_T) of the backfill materials be assumed to be 125 lbs/cu.ft, the submerged soil unit weight (γ'_s) of the backfill materials should be assumed to be 63 lbs/cu.ft and a coefficient of lateral earth pressure at-rest (K_o) of 0.45 for granular soils and 0.55 for cohesive soils should be used.

Figure 5 in the Appendix can be used to analyze uplift resistance for the structure due to buoyancy from the structure being watertight, submerged and undrained. It is recommended that the design high ground water level be considered approximately 12 ft below the existing ground surface, or higher if it is possible that flooding could occur in this area. As the base of the lift station could be below the design high water level, provisions must be included in the design of the lift station for the condition when the water level inside the lift station is insufficient to counteract the buoyancy due to the water level, in which case the lift station would be prone to floating or heaving. The uplift loads due to buoyancy of the structure can be resisted by the dead weight of the structure, including the weight of the mat foundation, and any fill that is placed over the lip or foundation extension of the structure as depicted in Figure 5 in the Appendix.

4.7 Gravity Sewer Lines

Based upon the test boring results described in Section 3, the existing soils revealed in the test borings at the estimated pipe invert elevations should provide adequate support for the proposed utility lines and any associated manholes, provided that the excavations are properly dewatered where necessary, prepared and inspected. Any extremely loose or soft soils noted within the base of an excavation should be removed and replaced with engineered fill. Proper dewatering when ground water is revealed is essential to prevent deterioration of the subgrade soils. Positive seals should be provided at joints between pipe sections according to the pipe manufacturer's specifications. It is recommended that the sewer be bedded in sand and that the backfill surrounding and overlying the pipe consist of sand that is free of large gravel or cobbles.

Based upon the test borings drilled across the project site, weathered shale and sandstone bedrock will need to be removed at some locations in order to establish the new sewer lines and associated structures. It likely will be possible to remove some of the upper weathered bedrock in most cases with conventional soil excavation equipment.

4.8 Construction Considerations

Temporary excavations for the installation of the utilities and any manholes should incorporate the use of trench boxes or other positive bracing or shoring methods such as properly designed soldier pile and lagging or steel sheet piling. All temporary excavation bracing or shoring measures required should be designed by an engineer registered in the State of Indiana. The contractor shall be responsible for all construction procedures, means and methods, construction sequencing, dewatering and all safety measures during construction. An open-cut excavation that is properly sloped and/or benched in accordance with OSHA regulations can be used where space allows. The excavations should comply with all federal, state and local safety requirements.

For planning purposes, it is recommended that temporary excavation sideslopes be made no steeper than 2 (horizontal) to 1 (vertical), or flatter as necessary depending upon the specific site conditions. Proper dewatering as described above is essential to maintaining the stability of the temporary excavation side slopes. Materials and heavy equipment should not be stored or staged within at least 10 ft of the crest of the excavations. Some sloughing of loose material should be expected with such slopes and the slopes should be continuously monitored to detect instabilities that may require remediation. A temporary earth retention system may be required in some areas to retain the surrounding soil and to protect nearby buildings, sidewalks, pavements and underground utility lines. The design of the temporary earth retention system is beyond the scope of this study and should be done by the specialty contractor that installs and maintains the system. Atlas is not responsible for the maintenance, stability or safety associated with any temporary excavation.

4.9 Site Grading and Drainage

Proper surface drainage should be provided at the site to minimize increase in moisture content of the backfill and foundation soils. The exterior grades should be sloped away from the structures to prevent ponding of water. Any roof drains or down spouts should be channelled or piped well away from the structures.

5 GENERAL CONSTRUCTION PROCEDURES AND RECOMMENDATIONS

Since this investigation identified actual subsurface conditions only at the test boring locations, it was necessary for our geotechnical engineers to extrapolate these conditions in order to characterize the entire project site. Even under the best of circumstances, the conditions encountered during construction can be expected to vary somewhat from the test boring results and may, in the extreme case, differ to the extent that modifications to the foundation recommendations become necessary. Therefore, we recommend that Atlas be retained as geotechnical consultant through the earth-related phases of this project to correlate actual soil conditions with test boring data, identify variations, conduct additional tests that may be needed and recommend solutions to earth-related problems that may develop.

5.1 Lift Station Excavation

It will be necessary to make a deep excavation for construction of the proposed lift station. A temporary earth retention system may be required to retain the surrounding soil and to protect the existing facilities from undermining and loss of support. Based on the depth to ground water encountered in the test borings across the project site, temporary dewatering measures likely will be required to control ground water for the deep excavation. The design of any temporary earth retention system and dewatering system/program are beyond the scope of this study and should be performed by an experienced specialty contractor that designs, installs and maintains the systems.

It is important to recognize that any temporary earth retention system will permit some movement (both horizontal and vertical) of the earth behind the retention system. The amount of movement of the earth retention system will depend upon the geometry of the system, stiffness of the members, the locations and capacities of the tie-back anchors, the location and loading of existing features, etc., as well as the care and expertise of the installer. It is recommended that the construction documents require that the temporary earth retention system be designed by a registered engineer in the State of Indiana and constructed by a qualified specialty contractor who is well-experienced in this type of work, with only certain performance items specified, such as allowable displacement restrictions (vertical and horizontal deflection), corrosion protection and tie-back testing, and definition regarding responsibility for the design, installation and maintenance of the system.

Where an open-cut excavation is possible, it is recommended that the temporary excavation sideslopes considered for planning purposes be no steeper than 2 (horizontal) to 1 (vertical). Unless detailed analyses are made based upon specific excavation geometry, structure loads, bearing elevations, etc., the crest of an excavation slope should be at least 15 ft away from any existing buildings, structures, equipment, etc. based upon excavation slopes of 2 (horizontal) to 1 (vertical), or flatter and adequate dewatering. The recommendations for temporary excavation slopes assume that the ground surface at the crest of the excavation slope is flat and that no significant, or permanent, surcharge loading is applied. If there is any surcharge loading on the slope or at the crest of the slope, specific analyses shall be required based upon the specific loading conditions, overall extent of the loading, loading intensity, etc. Some sloughing of loose material should be expected with such slopes and the slopes should be maintained as necessary, including flattening the slope if necessary, and continuously monitored for detection of instabilities that may require remediation.

The actual slope configurations for the temporary excavation must be determined by the contractor responsible for the temporary excavation, construction means and methods and site safety and should take into account the locations and loading from other adjacent facilities. The contractor's temporary excavation approach may be different than the approach suggested above for spatial planning purposes. The contractor shall be responsible for the specific means and methods and also has control of the project site on a continuing basis and the ability to make adjustments as determined necessary. All federal, state and local safety regulations should be followed in regard to open-cut excavations.

5.2 Fill Compaction

All engineered fill should be compacted to a dry density of at least 98 percent of the standard Proctor maximum dry density (ASTM D698). The compaction should be accomplished by placing the fill in about 8 in. thick (or less) loose lifts and mechanically compacting each lift to at least the specified minimum dry density. The moisture content of the fill materials should be within a range of about 3 percent below the optimum moisture content to the optimum moisture content. Field density tests should be performed on each lift as necessary to document moisture conditions and the actual compaction that is being achieved.

All soils encountered in the test boring are considered suitable as fill material with the exception of any near surface soils that contains more than 5 percent organic matter. The need for some aeration and moisture conditioning of the soils should be expected before they can be placed and compacted to the specified density.

It is recommended that only lean concrete (minimum compressive strength of at least 2,000 lbs/sq.in.) should be used for any fill that may be required beneath proposed mat foundations for the proposed lift station. It is also recommended that only well-graded granular material, such as pit-run sand and gravel or INDOT No. 53 crushed limestone, should be used to fill other excavations of limited lateral dimensions where proper compaction of cohesive materials is difficult and compaction can only be accomplished with small vibratory equipment.

5.3 Foundation Excavations

The soil at the base of each foundation excavation (mat foundations and spread footings) should be carefully observed and evaluated by a geotechnical engineer or a qualified soils technician to verify that any unsuitable soils are removed at the mat foundation or spread footing locations and that the mat foundations or spread footing will bear on satisfactory material as described in Section 4.2. All old fill, any remnants from previous construction (such as underground utilities, utility backfill, etc.), any soft natural soil or otherwise undesirable material must be removed from beneath the mat foundation and spread footing locations of the proposed structures and replaced with compacted fill as described in Section 5.2, or with lean concrete, so that the foundations will bear on satisfactory material. At the time of such inspection, it will be necessary to make hand auger borings or use a hand penetration device in the base of the foundation excavation to determine whether the soils below the base are satisfactory for foundation support. The necessary depth of penetration will be established during inspection.

Where undercutting is required to remove unsuitable materials, the proposed foundation bearing elevation may be re-established by backfilling after all undesirable materials have been removed. The undercut excavation beneath each spread footing or mat foundation should extend to suitable bearing soils and the dimensions of the excavation base should be determined by imaginary planes extending outward and downward on a 2 (vertical) to 1 (horizontal) slope from the base perimeter of the footing (see Figure 6 in the Appendix). The entire excavation should then be refilled with engineered fill (as described previously, lean concrete should be used for any lift station foundation undercuts). The engineered fill should be limited to well-graded sand and gravel or crushed stone (e.g., INDOT coarse aggregate size No. 53 crushed stone) compacted to the minimum dry density recommended in Section 5.1, or with lean concrete. Special care should be exercised to remove any sloughed, loose or soft materials near the base of the excavation slopes. In addition, special care should be taken to

"tie-in" the compacted fill with the excavation slopes with benches as necessary. This is to ensure that no pockets of loose or soft materials will be left in place along the excavation slopes below the foundation bearing level.

Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition such as from disturbance, rain and freezing. Surface run-off water should be drained away from the excavation and not allowed to pond. It is recommended that concrete "mud mats" be placed at the bases of the foundation excavations to protect the exposed foundation bearing soils from disturbance from construction activities and from deterioration due to seepage of ground water, surface water, construction traffic, etc.; and to aid in the proper placement of reinforcing steel.

5.4 Construction Dewatering

Depending on the seasonal conditions and the specific locations and depths of the excavations, some seepage of ground water into excavations should be expected due to ground water and/or perched water that may be encountered within sand or silt seams. It is anticipated that in most cases such seepage into excavations can be handled by conventional dewatering methods such as by pumping from sumps. However, in cases where a saturated silt or sand layer is encountered in the base of the excavation, it will not be possible to pump water directly from the base of the excavation without causing deterioration of the subsurface soils. In this case, it will be necessary to pump from a sump located adjacent to the excavation or to depress the ground water level using wells or well-points. The best dewatering system for each case must be determined at the time of construction based upon actual field conditions. If it is necessary to excavate below the static ground water level, it will be necessary to use wells or well points to depress the ground water level. The ground water level should be maintained to a depth of at 3 ft below the bottom of the excavation. A specialty dewatering contractor should be retained to install and maintain the dewatering system.

Temporary dewatering measures should be initiated well in advance of any excavation and the ground water level should be maintained at least 3 ft below the base of the deepest part of the excavation. Excavation should not commence until it is determined or demonstrated that the ground water level is at least 3 ft below the deepest part of the excavation or the ground water level has been sufficiently depressed. It is recommended that the dewatering program be developed, installed and maintained by a specialty dewatering contractor.

It is important to understand that ground water levels higher than those measured at the time of this investigation may be possible due to seasonal variations in the ground water level. The contractor should be prepared for variable ground water conditions, including cases as described above, and variable temporary dewatering conditions. It is recommended that an experienced specialty dewatering contractor be retained to provide temporary dewatering measures. It will not be possible to pump water directly from the base of an excavation that extends into, or even within several feet above, a saturated granular zone without causing deterioration of the foundation soil and possibly heaving of the soils and development of a quick condition.

6 FIELD INVESTIGATION

Thirty-two test borings were drilled at the approximate locations shown on the Boring Plans (Figures 2 and 3 in the Appendix). The borings were extended to depths of 15 ft to 40 ft below the existing grade. Split-barrel samples were obtained by the Standard Penetration Test procedures (ASTM D1586) at 2.5 ft and 5.0 ft intervals. In addition to the 32 test borings that were drilled specifically for this project, this study also includes 12 test borings that were previously drilled at the project site.

The test boring logs, which show visual descriptions of all soil strata encountered using the Unified Soil Classification System (ASTM D2488), have been included in the Appendix. Ground water observations, sampling information and other pertinent field data and observations are also included. In addition, a "Field Classification System for Soil Exploration" document defining the terms and symbols used on the test boring log and explaining the Standard Penetration Test procedure is provided immediately following the Test Boring Logs.

7 LABORATORY INVESTIGATION

The soil samples retained from the test borings and field sampling were inspected and classified by a geotechnical engineer in accordance with the Unified Soil Classification System (ASTM D2488), and the test boring logs were edited as necessary. To aid in classifying the soils and to determine general engineering soil characteristics of the soils, physical laboratory tests were performed on selected soil samples. The physical laboratory tests performed on the selected soil samples are summarized in the following table.

Table No. 3 – Laboratory Testing Program

Laboratory Test Description	Test Method Designation
Standard Practice for Description and Identification of Soils by Visual-Manual Procedures	ASTM D2488
Moisture Content Test of Soils	ASTM D2216
Atterberg Limits Tests	ASTM D4318
Unconfined Compressive Strength of Soil	ASTM D2166
Particle-Size Distribution of Soils Using Sieve Analysis	ASTM D6913
Marl Content (CaCO ₃ /MgCO ₃ Content)	ASTM D4373
Organic Content (Loss-on-Ignition Test)	ASTM D2974
Calibrated Hand Penetrometer Test ("Pocket Penetrometer Test")	NA

NA – No standardized test method available.

The results of the physical laboratory tests are included on the Test Boring Logs and laboratory test results sheets in the Appendix.

8 LIMITATIONS OF STUDY

An inherent limitation of any geotechnical engineering study is that conclusions must be drawn on the basis of data collected at a limited number of discrete locations. The recommendations provided in this report were developed from the information obtained from the test boring that depict subsurface conditions only at this specific location and at the particular time designated on the test boring log. Soil and ground water conditions at other locations may differ from conditions occurring at these test boring locations. The nature and extent of variations between the test borings may not become evident until the course of construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report after performing on-site observations during the excavation period and noting the characteristics of any variation.

Any comments or recommendations made herein regarding construction related issues or temporary conditions are solely for the purpose of evaluating feasibility and constructability and planning the design of the proposed facilities. The scope of this investigation is not sufficient to identify all potential construction related issues, variations, anomalies, etc. or all factors that may affect construction means, methods and costs.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either express or implied. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the field exploration and laboratory test data presented in this report.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, ground water or surface water within or beyond the site studied.

Atlas assumes no responsibility for any construction procedures, temporary excavations (including utility trenches), temporary dewatering or site safety during or after construction. The contractor shall be solely responsible for all construction procedures, construction means and methods, construction sequencing and for safety measures during construction as well as the protection of all existing facilities. All applicable federal, state and local laws and regulations regarding construction safety must be followed, including current Occupational Safety and Health Administration (OSHA) Regulations including OSHA 29 CFR Part 1926 "Safety and Health Regulations for Construction", Subpart P "Excavations", and/or successor regulations. The Contractor shall be solely responsible for designing and constructing stable, temporary excavations and should brace, shore, slope, or bench the sides of the excavations as necessary to maintain stability of the excavation sides and bottom and to protect the integrity of all existing facilities (i.e., roadways, utilities, etc.).

Appendix

- Figure 1: Vicinity Map
- Figure 2: Boring Plan – Overall Site
- Figure 3: Boring Plan – Wastewater Treatment Plant
- Figure 4: Lateral Earth Pressure Against Below-Grade Wall Assuming Undrained Backfill with Hydrostatic Pressure
- Figure 5: Design Illustration – Uplift Considerations of Submerged Below-Grade Structure
- Figure 6: Design Illustration – Footings with Undercuts

Test Boring Logs for This Study (32)

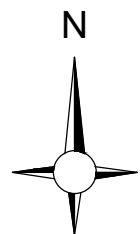
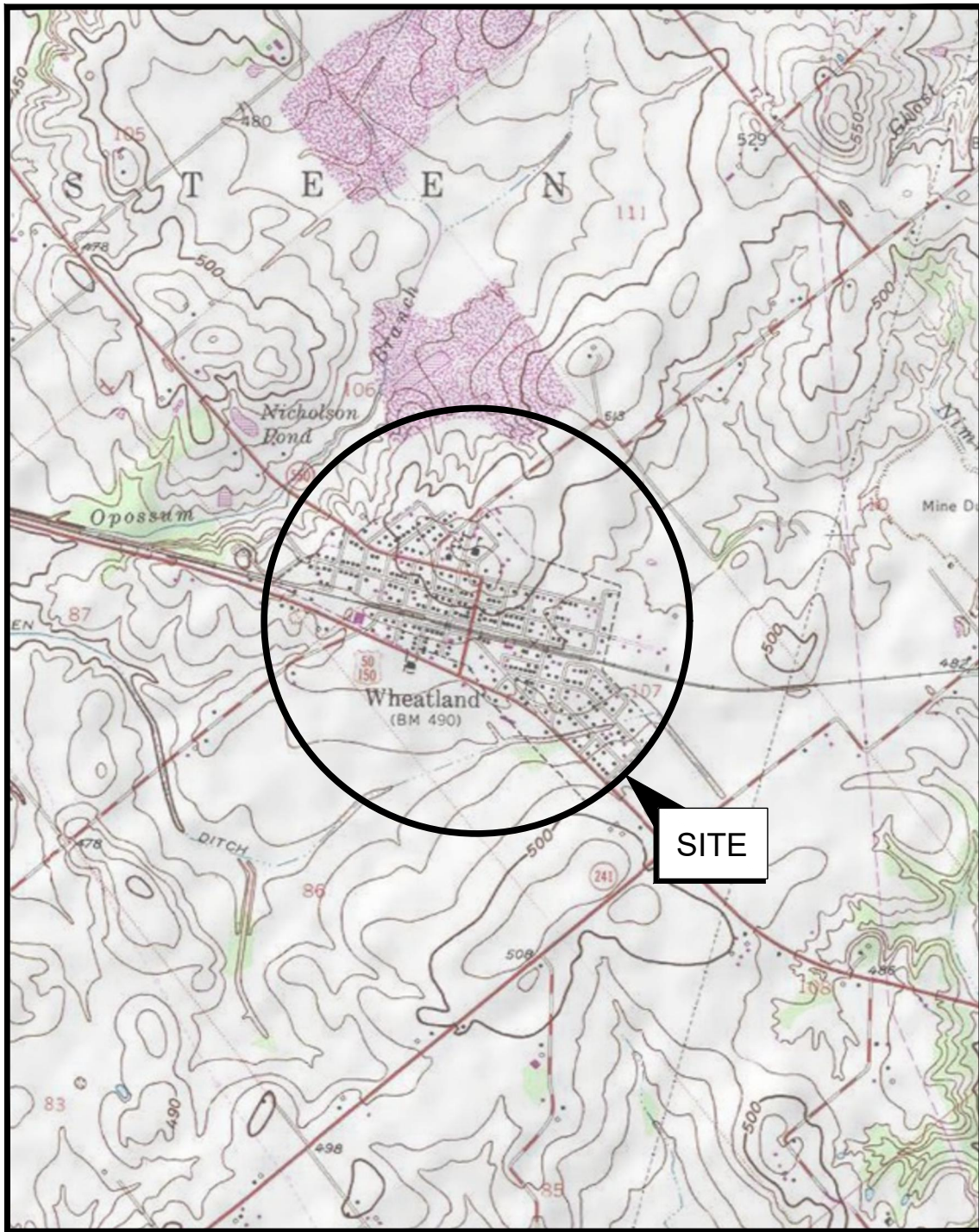
Test Boring Logs for Previous Study (12)

“Field Classification System for Soil Exploration”

Unconfined Compressive Strength Test Reports (5)

Grain Size Distribution Test Reports (7)

“Important Information About Your Geotechnical Engineering Report”



H:\2022\TOWN OF WHEATLAND\170GC01517\170GC01517-VIC.DWG, FIG 1

VICINITY MAP

PROPOSED WASTEWATER TREATMENT PLANT AND GRAVITY SEWER SYSTEM
WHEATLAND, INDIANA

Project Number: 170GC01517		Drn. By: BM
Date: 11/16/2022	Scale: 1"=2,000'	Ckd. By: DM



LEGEND:

- B-101 TEST BORING
Boring Identification
- B-1 PREVIOUS TEST BORINGS -
ATLAS PROJECT #170GC01308
Boring Identification

NOTE: ALL LOCATIONS ARE APPROXIMATE




BORING PLAN - OVERALL SITE
 PROPOSED WASTEWATER TREATMENT PLANT AND GRAVITY SEWER SYSTEM
 WHEATLAND, INDIANA

Project Number: 170GC01517	
Date: 01/05/2023	
Drn. By: BM	Ckd. By: DM
Scale: AS SHOWN	
Figure: 2	

H:\2023\TOWN OF WHEATLAND\170GC01517\170GC01517-BPLAN.DWG, FIG 2

SCALE: 1" = 400'

LEGEND:

B-101 TEST BORING
 Boring Identification

NOTE: ALL LOCATIONS ARE APPROXIMATE

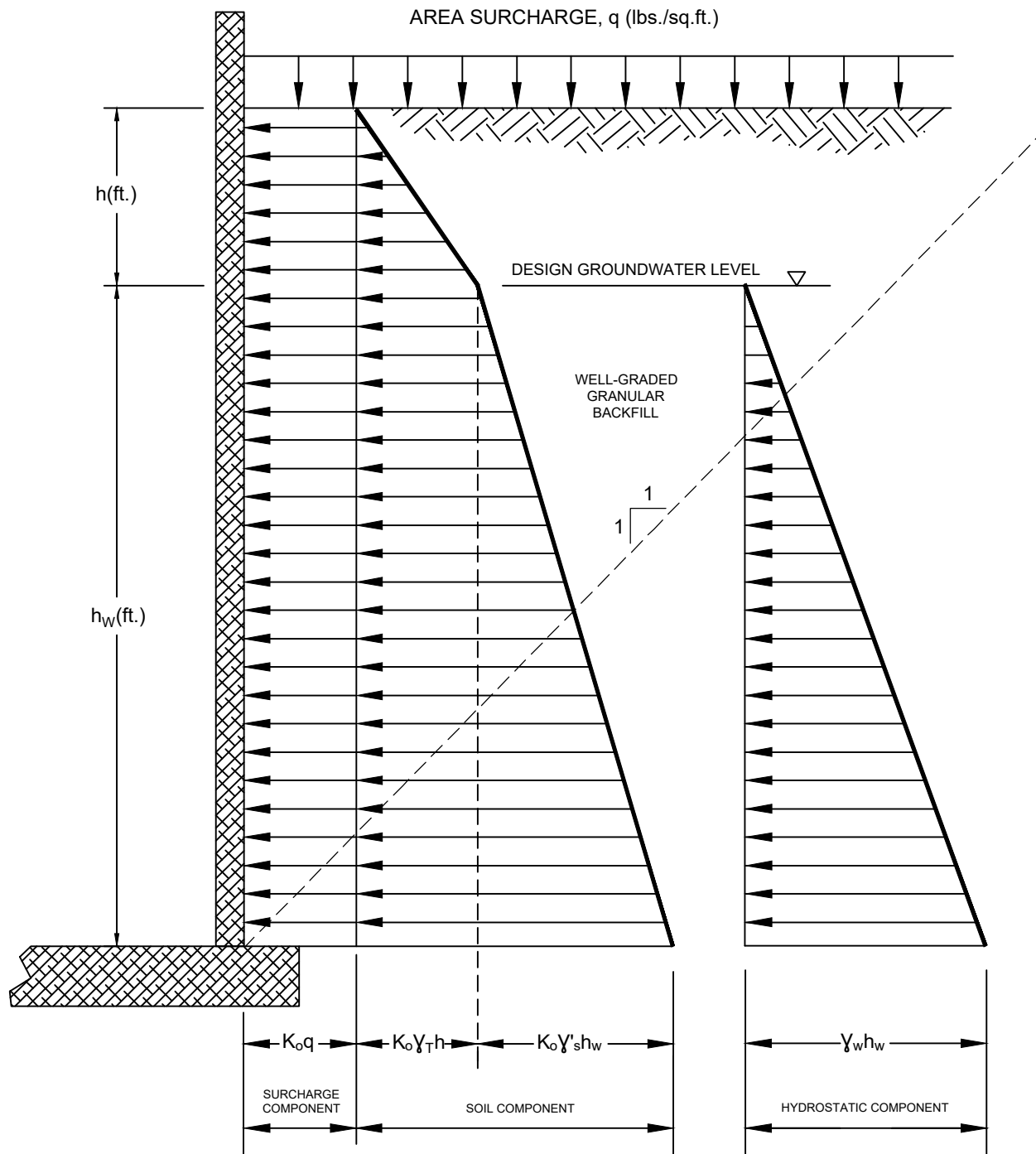


H:\2022\TOWN OF WHEATLAND\170GC01517\170GC01517-BPLAN2.DWG, FIG 3

BORING PLAN - WASTEWATER TREATMENT PLANT
 PROPOSED WASTEWATER TREATMENT PLANT AND GRAVITY
 SEWER SYSTEM
 WHEATLAND, INDIANA

Project Number: 170GC01517	Scale: AS SHOWN	Drn. By: BM
Date: 12/07/2022		Ckd. By: DM

 **3**



h_w = DEPTH FROM DESIGN HIGH GROUND WATER LEVEL TO BASE OF WALL (ft.)

γ'_s = SUBMERGED SOIL UNIT WEIGHT (lbs./cu.ft.)

γ_w = UNIT WEIGHT OF WATER (lbs./cu.ft.)

γ_T = TOTAL SOIL UNIT WEIGHT (lbs./cu.ft.)

K_o = COEFFICIENT OF LATERAL EARTH PRESSURE AT-REST

q = AREA SURCHARGE, q (lbs./sq.ft.)

**LATERAL EARTH PRESSURE AGAINST BELOW-GRADE WALL
ASSUMING UNDRAINED BACKFILL W/ HYDROSTATIC PRESSURE**

PROPOSED WASTEWATER TREATMENT PLANT AND GRAVITY SEWER SYSTEM
WHEATLAND, INDIANA

Project Number:
170GC01517

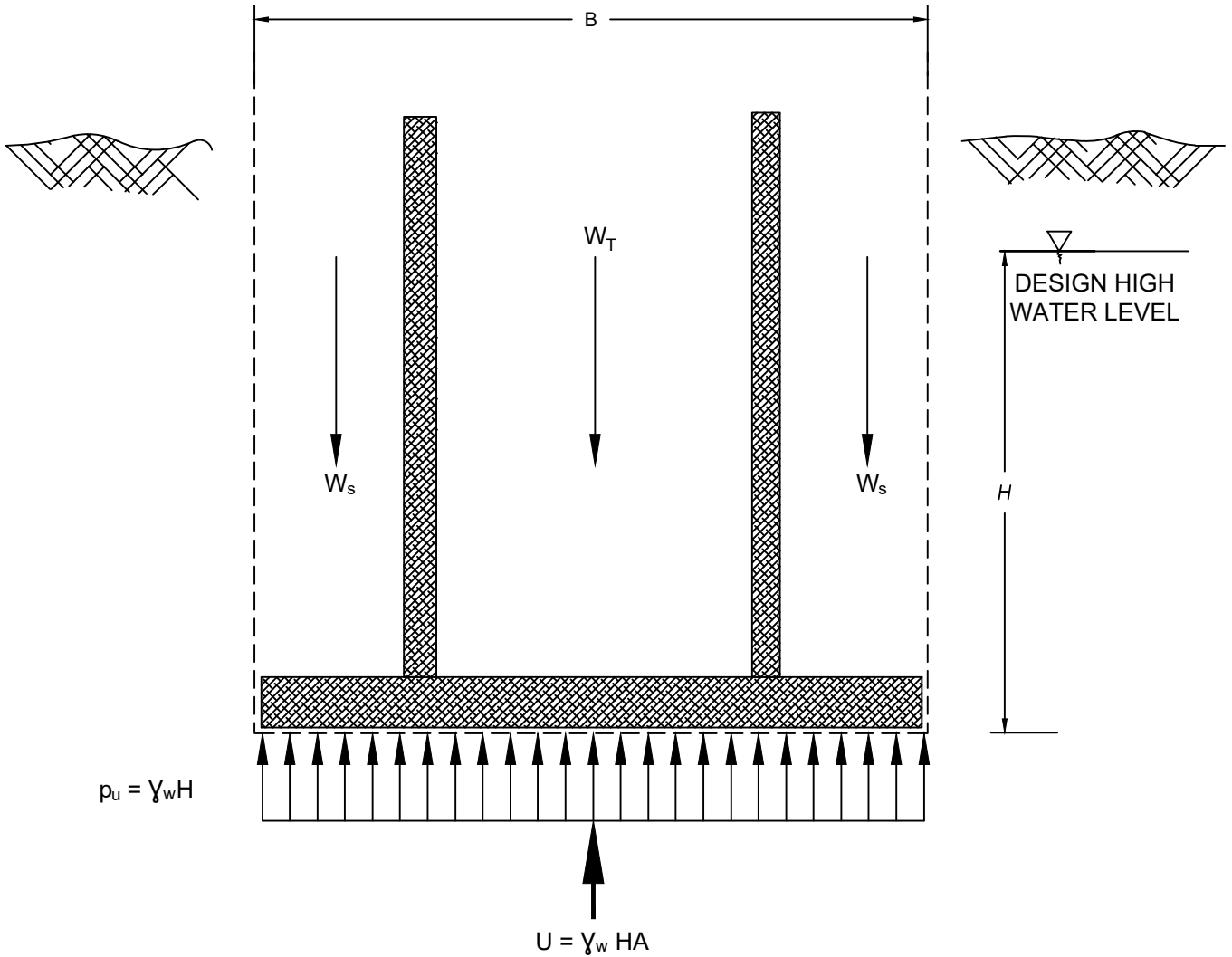
Date:
01/05/2023

Scale:
NOT TO SCALE

Drn. By:
BM

Ckd. By:
DM





NOTE: FOR THIS DESIGN APPROACH, TOTAL (NOT BUOYANT) WEIGHTS OF SOIL AND STRUCTURE MATERIALS WITHIN THE DASHED LINES SHOULD BE USED

- H = DEPTH FROM DESIGN HIGH GROUND WATER LEVEL TO BOTTOM OF STRUCTURE (ft.)
- γ_w = UNIT WEIGHT OF WATER (lbs./cu. ft.)
- p_u = UPLIFT PRESSURE AT BASE OF FOUNDATION OR SLAB (lbs./sq.ft.)
- U = TOTAL UPLIFT FORCE (lbs.)
- W_T = WEIGHT OF STRUCTURE (lbs.)
- W_s = WEIGHT OF SOIL OVER FOUNDATION SLAB (lbs.)
- A = AREA OF STRUCTURE BASE (sq.ft.)

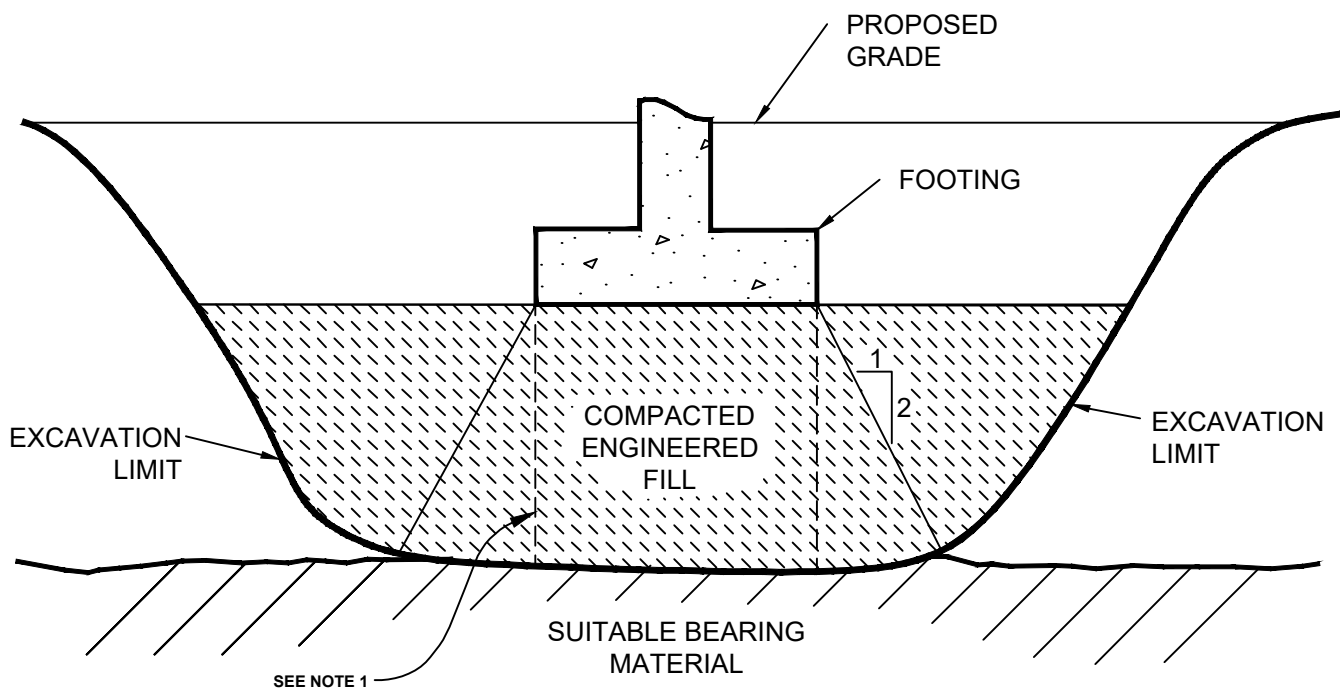
DESIGN ILLUSTRATION-UPLIFT CONSIDERATION OF SUBMERGED BELOW-GRADE STRUCTURE

PROPOSED WASTEWATER TREATMENT PLANT AND GRAVITY SEWER SYSTEM
WHEATLAND, INDIANA

Project Number: 170GC01517		Drn. By: BM
Date: 11/30/2022	Scale: NOT TO SCALE	Ckd. By: DM



H:\2022\TOWN OF WHEATLAND\170GC01517\170GC01517-BPLAN.DWG, UPLIFT



NOTE 1: Expanded (2V:1H) undercut zone not necessary where concrete/lean concrete is used as undercut backfill in lieu of engineered fill and where adequate bearing soils are exposed at the base of undercut. Refer to report Section 5.3.

H:\2022\TOWN OF WHEATLAND\170GC01517\170GC01517-UNCUT.DWG, UNCUT

DESIGN ILLUSTRATION FOOTINGS WITH UNDERCUTS

PROPOSED WASTEWATER TREATMENT PLANT AND GRAVITY SEWER SYSTEM
WHEATLAND, INDIANA

Project Number: 170GC01517		Drn. By: BM
Date: 01/05/2023	Scale: NOT TO SCALE	Ckd. By: DM





CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-101
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/20/22 Hammer Wt. 140 lbs.
 Date Completed 12/20/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 479												
4 in. Topsoil	478.7	0.3										
Brown, moist, medium stiff, CLAY (CH)	476.0	3.0		1	SS				3-4-6	25.7	2.5	Ground surface elevation estimated from plans provided by client. Sample No. 1: Atterberg Limits: LL=67 PL=25 PI=42 Sample No. 3: Atterberg Limits: LL=39 PL=17 PI=22 Unconfined Compressive Strength = 1.2 tsf Dry Density = 105.5 pcf Sample No. 5: Atterberg Limits: LL=50 PL=16 PI=34 Sample Nos. 8 & 9: Finer than #200 Sieve = 16.9% Sample Nos. 10 & 11: Finer than #200 Sieve = 7.7% Sample No. 16: Unconfined Compressive Strength = 1.5 tsf Dry Density = 113.6 pcf
Brown and gray, moist, medium stiff, SILTY CLAY (CL) with trace sand	473.5	5.5	5	2	SS				3-3-3	24.8	1.5	
Gray, moist, medium stiff, SILTY CLAY (CL) with trace sand	468.5	10.5	10	3	SS				3-3-4	22.1	1.0	
Gray, moist, medium stiff, SILTY CLAY (CL) with trace sand	468.5	10.5	10	4	SS				2-3-3	21.6	1.5	
Brown and gray, moist, very soft, CLAY (CH)	466.0	13.0	13	5	SS				2-1-1	34.9	0.5	
Gray, moist, very soft, SILTY CLAY (CL) with trace sand and gravel	463.0	16.0	15	6	SS				1-1-2	29.1	0.5	
Gray, moist, very stiff, SILTY CLAY (CL) with some sand and trace gravel	461.0	18.0	18	7	SS				3-4-12	19.7		
Gray, wet, medium dense to loose, SILTY SAND (SM)	456.0	23.0	20	8	SS				5-7-10			
Gray, wet, loose to dense, SAND (SP-SM) with trace silt and gravel	456.0	23.0	20	9	SS			▽	5-5-5			
Gray, wet, loose to dense, SAND (SP-SM) with trace silt and gravel	456.0	23.0	25	10	SS				5-4-6			
Gray, wet, loose to dense, SAND (SP-SM) with trace silt and gravel	456.0	23.0	30	11	SS				5-6-7			
Gray, wet, loose to dense, SAND (SP-SM) with trace silt and gravel	456.0	23.0	30	12	SS				5-6-9			
Gray, wet, loose to dense, SAND (SP-SM) with trace silt and gravel	456.0	23.0	35	13	SS				13-19-25			
Gray, wet, loose to dense, SAND (SP-SM) with trace silt and gravel	443.5	35.5	35	14	SS				5-9-7			
Gray, slightly moist, medium stiff to stiff, SILTY CLAY (CL) with little sand and trace gravel	443.5	35.5	35	15	SS				3-4-6	20.0	1.5	
Bottom of Test Boring at 40.0 ft.	439.0	40.0	40	16	SS				4-6-7	17.9	2.5	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 18.0 ft.
- ▽ At Completion 21.8 ft.
- ▽ After -- hours -- ft.
- ⊠ Cave Depth 23.5 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-102
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/1/22 Hammer Wt. 140 lbs.
 Date Completed 12/1/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 480												
6 in. Topsoil	479.5	0.5										Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=38 PL=23 PI=15
Dark brown, moist, medium stiff, SILTY CLAY (CL) with trace sand	477.0	3.0		1	SS	X	■		3-4-3	20.8	3.5	
Light brown and gray, moist, soft, SILTY CLAY (CL)	474.0	6.0	5	2	SS	X	■		2-2-3	27.5	1.0	
Gray, moist, medium stiff to very soft, SILTY CLAY (CL) with trace sand				3	SS	X	■		3-3-3	22.2	1.0	
			10	4	SS	X	■		3-1-2	21.2	1.0	
				5	SS	X	■		2-1-2	26.4	1.0	
			15	6	SS	X	■		0-2-2	23.5	1.25	
Gray, wet, medium dense, SILTY SAND (SM) with trace gravel	461.5	18.5					●					
Bottom of Test Boring at 20.0 ft.	460.0	20.0	20	7	SS	X	■		5-5-7			

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 17.0 ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth -- ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-103
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 11/30/22 Hammer Wt. 140 lbs.
 Date Completed 11/30/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 479												
6 in. Topsoil	478.5	0.5										Ground surface elevation estimated from plans provided by client. Sample No. 3: Atterberg Limits: LL=45 PL=18 PI=27 Unconfined Compressive Strength = 0.8 tsf Dry Density = 100.9 pcf Sample No. 5: Atterberg Limits: LL=58 PL=16 PI=42 Unconfined Compressive Strength = 0.8 tsf Dry Density = 91.3 pcf
Brown, moist, stiff, SILTY CLAY (CL)	476.0	3.0		1	SS				7-8-7	28.4	2.25	
Light brown and gray, moist, soft, SILTY CLAY (CL)	473.0	6.0	5	2	SS				2-3-2	26.0	0.5	
Gray, moist, medium stiff to soft, SILTY CLAY (CL)	468.5	10.5	10	3	SS				3-4-3	23.1	1.0	
Gray, moist, very soft, CLAY (CH)	466.0	13.0	15	4	SS				3-2-3	22.9	1.75	
Tan and gray, moist, very soft, SILTY CLAY (CL)	460.5	18.5	20	5	SS				2-1-2	31.3	0.5	
				6	SS				2-1-1	30.6	0.5	
Gray, slightly moist, stiff to hard, SILTY CLAY (CL) with little sand and trace gravel	454.0	25.0	25	7	SS				5-6-8	13.4	2.0	
Bottom of Test Boring at 25.0 ft.				8	SS				10-13-25	14.7	2.0	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 23.5 ft.
- ∇ At Completion 22.0 ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 22.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-104
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/1/22 Hammer Wt. 140 lbs.
 Date Completed 12/1/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 479												
6 in. Topsoil	478.5	0.5										
Brown, moist, medium stiff, CLAY (CH)	476.0	3.0		1	SS	X	█		2-4-3	28.6	1.75	Ground surface elevation estimated from plans provided by client. Sample No. 1: Atterberg Limits: LL=59 PL=27 PI=32 Sample No. 5: Atterberg Limits: LL=58 PL=17 PI=41 Unconfined Compressive Strength = 0.8 tsf Dry Density = 94.6 pcf
Tan, moist, medium stiff, SILTY CLAY (CL)	473.5	5.5	5	2	SS	X	█		3-3-4	26.9	1.0	
Gray, moist, medium stiff to soft, SILTY CLAY (CL)	468.5	10.5	10	3	SS	X	█		3-3-5	22.4	1.0	
Gray and brown, moist, soft, CLAY (CH)	466.0	13.0	15	4	SS	X	█		3-2-3	25.8	1.0	
Brown and gray, moist, soft, SILTY CLAY (CL) with trace sand	460.5	18.5	18	5	SS	X	█		1-2-3	28.2	1.0	
Gray, slightly moist, stiff, SILTY CLAY (CL) with little sand and trace gravel	459.0	20.0	20	6	SS	X	█		1-2-2	28.7	2.25	
Bottom of Test Boring at 20.0 ft.				7	SS	X	█		5-6-8	15.0	2.25	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 17.8 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-105
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/7/22 Hammer Wt. 140 lbs.
 Date Completed 12/7/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION		Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 486													
5 in. Asphalt over 10 in. Aggregate Base		484.7	1.3										Ground surface elevation estimated from plans provided by client. Sample No. 6: Atterberg Limits: LL=35 PL=17 PI=18
Gray, brown, and dark brown, moist, silty clay with trace sand (FILL)		482.5	3.5		1	SS			5-3-3	20.9			
Brown, moist, medium stiff, SILTY CLAY (CL)		480.5	5.5	5	2	SS			4-4-5	22.7	1.5		
Brown and gray, moist, stiff to medium stiff, SILTY CLAY (CL)					3	SS			3-5-6	24.4	1.75		
				10	4	SS			2-3-4	18.9	1.5		
		473.0	13.0		5	SS			3-4-5	18.2	2.5		
Brown, moist, medium stiff, SILTY CLAY (CL)		470.5	15.5	15	6	SS			3-3-5	26.0	1.25		
Brown and gray, moist, stiff, SILTY CLAY (CL) with little sand and trace gravel		468.0	18.0		7	SS			4-6-7	17.6	1.75		
Brown, wet, medium dense, CLAYEY SAND (SC)		466.0	20.0	20	8	SS			5-6-7				
Bottom of Test Boring at 20.0 ft.													

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion 17.3 ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 18.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-106
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/8/22 Hammer Wt. 140 lbs.
 Date Completed 12/8/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 484												
6 in. Asphalt	483.5	0.5										Ground surface elevation estimated from plans provided by client. Sample No. 3: Atterberg Limits: LL=33 PL=15 PI=18
Gray, slightly moist, silty clay with little sand (FILL)	480.5	3.5		1	SS				8-6-4	17.3		
Brown and gray, moist, medium stiff to soft, SILTY CLAY (CL)			5	2	SS				3-2-4	24.6	1.0	
				3	SS				3-2-3	21.2	1.5	
Gray and brown, moist, medium stiff, SILTY CLAY (CL) with trace sand	475.5	8.5		4	SS				3-2-4	18.8	1.5	
	473.5	10.5	10	5	SS				2-3-3	24.2	1.0	
Orangish brown, moist, medium stiff, SANDY SILTY CLAY (CL)	471.0	13.0		6	SS				2-2-1			
Orangish brown, moist, very loose, CLAYEY SAND (SC)	468.5	15.5	15	7	SS				6-7-3			
Gray, wet, loose, SILTY SAND (SM)	466.0	18.0		8	SS				2-3-4	19.7	1.0	
Gray, moist, medium stiff, SILTY CLAY (CL) with trace sand and gravel	464.0	20.0	20									
Bottom of Test Boring at 20.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 17.5 ft.
- ▽ At Completion 15.0 ft.
- ▽ After -- hours -- ft.
- ⊠ Cave Depth 16.0 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-107
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/7/22 Hammer Wt. 140 lbs.
 Date Completed 12/7/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 493												
6 in. Asphalt	492.5	0.5										Ground surface elevation estimated from plans provided by client.
Brown and gray, moist, medium stiff, SILTY CLAY (CL)	490.0	3.0		1	SS				4-4-4	29.0		
Brown, moist, medium stiff, SILTY CLAY (CL)				2	SS				3-4-4	26.6	1.0	
			5	3	SS				2-3-3	20.7	1.0	
Brown, moist, soft, SILTY CLAY (CL) with trace sand	485.0	8.0		4	SS				3-2-3	21.6	1.5	
Brown and orangish brown, moist, medium stiff to stiff, SILTY CLAY (CL) with sandstone fragments and trace sand	482.0	11.0	10	5	SS				3-4-6	15.1	3.5	
				6	SS				4-5-6	40.2	2.25	
Tan, severely weathered, SHALE	477.0	16.0	15	7	SS				15-43-50/0.2	14.1		
				8	SS				50/0.2			
Gray, weathered, SHALE	472.5	20.5	20	9	SS				50/0.2			
Bottom of Test Boring at 23.7 ft.	469.3	23.7		10	SS				50/0.2			Auger refusal at 23.7 ft.

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 16.0 ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 19.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-108
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/7/22 Hammer Wt. 140 lbs.
 Date Completed 12/7/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION		Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 482													
6 in. Asphalt over 8 in. Aggregate Base		480.8	1.2										Ground surface elevation estimated from plans provided by client. Sample No. 3: Atterberg Limits: LL=33 PL=21 PI=12
Gray and dark gray, slightly moist, silty clay with trace sand and gravel (FILL)		478.5	3.5		1	SS				2-3-5	24.1		
Brown and gray, moist, medium stiff to soft, SILTY CLAY (CL)		471.5	10.5	5	2	SS				2-3-4	26.9	1.5	
					3	SS				2-2-3	26.0		
					4	SS			1-2-3	29.8	1.0		
Gray and brown, moist, soft, SILTY CLAY (CL) with little sand		466.0	16.0	10	5	SS				2-2-2	24.3	1.5	
Brown, moist, medium stiff, SILTY CLAY (CL) with trace sand					6	SS			▽	1-2-3	19.9	1.5	
		Brown, moist, very stiff, SILTY CLAY (CL) with sandstone fragments and trace sand		464.0	18.0	15	7	SS			3-2-4	20.2	
Bottom of Test Boring at 20.0 ft.		462.0	20.0	20	8	SS				8-10-15	19.3	2.0	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 16.0 ft.
- ▽ At Completion 14.0 ft.
- ▽ After -- hours -- ft.
- Cave Depth 18.5 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-109
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/22 Hammer Wt. 140 lbs.
 Date Completed 12/6/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 488												
12 in. Asphalt	487.0	1.0										
Dark gray, moist, silty clay (FILL)	484.5	3.5		1	SS	X			5-2-3	24.7		Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=51 PL=24 PI=27 Organic Content = 1.5% Sample No. 3: Atterberg Limits: LL=36 PL=20 PI=16
Gray, moist, medium stiff, CLAY (CH) with trace organics	482.5	5.5	5	2	SS	X			3-2-4	30.2	1.0	
Brown and gray, moist, soft, SILTY CLAY (CL)				3	SS	X			3-2-2	22.7	0.75	
	477.5	10.5	10	4	SS	X			3-3-2	21.5	1.5	
Gray and brown, moist, medium stiff, SILTY CLAY (CL) with trace sand				5	SS	X			3-4-2	22.7	1.5	
	473.0	15.0	15	6	SS	X			2-3-5	19.9	2.25	
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-110
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/5/22 Hammer Wt. 140 lbs.
 Date Completed 12/5/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 479												
10 in. Asphalt	478.2	0.8										Ground surface elevation estimated from plans provided by client.
Dark gray, moist, silty clay (FILL)	475.5	3.5		1	SS				7-5-4	27.0		
Brown and gray, moist, medium stiff, SILTY CLAY (CL)	473.5	5.5	5	2	SS				4-3-4	27.4	1.0	
Brown, moist, soft, SILTY CLAY (CL)	470.5	8.5		3	SS				2-2-3	18.6	1.75	
Gray and brown, moist, medium stiff, SILTY CLAY (CL) with trace sand	468.5	10.5	10	4	SS				3-2-4	18.2	2.25	
Brown and gray, moist, very soft, CLAY (CH) with trace sand	466.0	13.0		5	SS				3-2-1	38.7	1.0	
Gray and brown, moist, very soft, SILTY CLAY (CL) with some sand	463.0	16.0	15	6	SS				1-2-1	23.7		
Orangish brown, wet, very loose, CLAYEY SAND (SC) with trace gravel	458.0	21.0	20	7	SS				2-2-2			
Gray, slightly moist, stiff, SILTY CLAY (CL) with trace sand and gravel	454.4	24.6		8	SS				3-2-2			
				9	SS				3-4-7	17.6	2.0	
				10	SS				4-6-50/0.1	16.0	3.0	
Bottom of Test Boring at 24.6 ft.												

Sample Nos. 7 & 8:
 Finer than #200 Sieve = 18.2%

- | | | |
|------------------------------|---|--------------------------------|
| Sample Type | Depth to Groundwater | Boring Method |
| SS - Driven Split Spoon | ● Noted on Drilling Tools <u>16.0</u> ft. | HSA - Hollow Stem Augers |
| ST - Pressed Shelby Tube | ∇ At Completion <u>19.0</u> ft. | CFA - Continuous Flight Augers |
| CA - Continuous Flight Auger | ∇ After <u>--</u> hours <u>--</u> ft. | CA - Casing Advancer |
| RC - Rock Core | ⊕ Cave Depth <u>21.0</u> ft. | MD - Mud Drilling |
| CU - Cuttings | | HA - Hand Auger |
| CT - Continuous Tube | | |



CLIENT Town of Wheatland BORING # B-111
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/2/22 Hammer Wt. 140 lbs.
 Date Completed 12/2/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 485												
15 in. Asphalt	484.6	0.4										Ground surface elevation estimated from plans provided by client. Sample No. 5: Atterberg Limits: LL=61 PL=17 PI=44 Sample No. 6: Finer than #200 Sieve = 14.4%
Gray, moist, medium stiff, SILTY CLAY (CL)	482.0	3.0		1	SS				4-4-5	30.5	2.0	
Brown, moist, soft, SILTY CLAY (CL)	479.5	5.5	5	2	SS				2-2-2	28.1	0.5	
Brown and gray, moist, soft to medium stiff, SILTY CLAY (CL)	474.5	10.5	10	3	SS				2-2-2	19.8	1.5	
Brown and gray, moist, medium stiff, CLAY (CH)	472.0	13.0	13	4	SS				3-2-4	20.2	1.5	
Dark brown, moist, loose, CLAYEY SAND (SC) with trace gravel	469.5	15.5	15	5	SS				3-3-4	29.8	1.5	
Orangish brown, brown, and gray, severely weathered, SANDSTONE	467.0	18.0	18	6	SS				4-3-6			
Tan, weathered, SHALE			20	7	SS				2-3-4	21.0		
			25	8	SS				13-44-50/0.1	15.4		
			30	9	SS				50/0.3			
			35	10	SS				50/0.2	13.0		
Gray, weathered, SHALE	457.0	28.0		11	SS				50/0.3			
				12	SS				50/0.3			
				13	SS				50/0.3	11.5		
Bottom of Test Boring at 35.0 ft.	450.0	35.0		14	SS				50/0.1			

Sample Type
 SS - Driven Split Spoon
 ST - Pressed Shelby Tube
 CA - Continuous Flight Auger
 RC - Rock Core
 CU - Cuttings
 CT - Continuous Tube

Depth to Groundwater
 ● Noted on Drilling Tools None ft.
 ∇ At Completion None ft.
 ▼ After -- hours -- ft.
 ☒ Cave Depth -- ft.

Boring Method
 HSA - Hollow Stem Augers
 CFA - Continuous Flight Augers
 CA - Casing Advancer
 MD - Mud Drilling
 HA - Hand Auger



CLIENT Town of Wheatland BORING # B-112
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/22 Hammer Wt. 140 lbs.
 Date Completed 12/6/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 480												
6 in. Asphalt	479.5	0.5										Ground surface elevation estimated from plans provided by client.
Dark gray, slightly moist, silty clay with trace sand (FILL)	476.5	3.5		1	SS	X			7-4-4	14.6		
Brown and gray, moist, soft, SILTY CLAY (CL)	474.0	6.0	5	2	SS	X			3-1-3	26.7	0.25	
Brown, moist, medium stiff to soft, SILTY CLAY (CL)	469.5	10.5	10	3	SS	X			3-2-4	17.8	1.0	
Gray and brown, moist, medium stiff, SILTY CLAY (CL) with trace sand	467.0	13.0	15	4	SS	X			3-2-3	18.5	1.25	
Brown and gray, moist, medium stiff, SANDY SILTY CLAY (CL) with sandstone fragments	465.0	15.0		5	SS	X			3-4-3	22.3	1.5	
Bottom of Test Boring at 15.0 ft.				6	SS	X			3-3-6	21.0	1.0	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 12.8 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-113
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/5/22 Hammer Wt. 140 lbs.
 Date Completed 12/5/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 483												
9 in. Asphalt	482.2	0.8										Ground surface elevation estimated from plans provided by client.
Tan, moist, silty clay with brick fragments (FILL)	479.5	3.5		1	SS				11-7-6			
Brown, moist, medium stiff, SILTY CLAY (CL)			5	2	SS				3-3-5	24.5	1.25	
				3	SS				3-5-5	16.7	1.0	
				4	SS				3-3-3	15.9	1.5	
Brown and gray, moist, soft, SILTY CLAY (CL) with trace sand	472.5	10.5	10	5	SS				2-1-3	24.6	1.5	
				6	SS				2-3-4	19.8	0.75	
Light gray, moist, medium stiff, SANDY SILTY CLAY (CL)	469.5	13.5										
Gray, slightly moist, medium stiff to stiff, SILTY CLAY (CL) with trace sand and gravel	467.5	15.5	15	7	SS				3-4-5	16.8		
				8	SS				5-6-7	16.9	2.5	
Brown and gray, severely weathered, SHALE	462.5	20.5	20									
Brown and gray, weathered, SHALE	460.0	23.0		9	SS				9-13-23	82.3		
				10	SS				15-17-19	19.5		
Bottom of Test Boring at 25.0 ft.	458.0	25.0	25									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 23.0 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-114
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/22 Hammer Wt. 140 lbs.
 Date Completed 12/6/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 478												
6 in. Asphalt	477.5	0.5										
Gray, moist, medium stiff to soft, SILTY CLAY (CL) - trace organics below 3 ft.				1	SS				4-3-5	21.8		Ground surface elevation estimated from plans provided by client.
				2	SS				3-2-3	24.2	1.5	Sample No. 2: Organic Content = 1.7%
Light gray, moist, soft, SILTY CLAY (CL) with trace organics and gravel	472.5	5.5	5	3	SS				2-2-3	20.6	2.0	Sample No. 3: Organic Content = 1.6%
	469.5	8.5		4	SS				3-2-4	22.4	1.5	
Dark brown and brown, moist, medium stiff, SILTY CLAY (CL)	467.5	10.5	10	5	SS				3-3-4	24.2	1.5	Sample No. 5: Atterberg Limits: LL=44 PL=15 PI=29
Light gray, moist, medium stiff, SILTY CLAY (CL)	465.0	13.0		6	SS				3-3-3	18.0		
Brown and gray, moist, medium stiff, SANDY SILTY CLAY (CL)	462.5	15.5	15	7	SS				3-4-7	20.2	1.5	
Gray, slightly moist, stiff to medium stiff, SILTY CLAY (CL) with trace sand and gravel				8	SS				3-4-5	18.0	2.0	
	457.0	21.0	20	9	SS				50/0.3	9.9		
Tan weathered, SHALE				10	SS				50/0.1			Auger refusal at 23.6 ft.
Bottom of Test Boring at 23.6 ft.	454.4	23.6										

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 16.0 ft.
- ▽ At Completion 18.0 ft.
- ▽ After -- hours -- ft.
- ⊠ Cave Depth 21.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-115
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/5/22 Hammer Wt. 140 lbs.
 Date Completed 12/5/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION		Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 479													
7.5 in. Asphalt over 8 in. Aggregate Base		477.7	1.3										Ground surface elevation estimated from plans provided by client.
Gray, slightly moist, silty clay with trace sand and gravel (FILL)		475.5	3.5		1	SS				7-5-6	19.3		
Brown, moist, soft to medium stiff, SILTY CLAY (CL)				5	2	SS				3-2-2	22.6	1.5	
					3	SS				3-3-3	17.6	1.5	
				10	4	SS				3-2-3	19.8	2.0	
Orangish brown, moist, stiff, SILTY CLAY (CL) with some to little sand and sandstone fragments		468.0	11.0		5	SS				4-5-6	21.7	2.0	
Brown, moist, loose, CLAYEY SAND (SC) with little gravel - wet below 14 ft.		466.0	13.0		6	SS		▽		3-3-4			
Gray, slightly moist, very stiff, SILTY CLAY (CL) with trace sand, gravel, and sandstone fragments		462.0	17.0	15	7	SS		●		3-4-5			
Bottom of Test Boring at 20.0 ft.		459.0	20.0	20	8	SS		●		4-6-11	17.7	2.0	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 16.0 ft.
- ▽ At Completion 14.0 ft.
- ▽ After -- hours -- ft.
- Cave Depth 16.8 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-116
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/5/22 Hammer Wt. 140 lbs.
 Date Completed 12/5/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 479												
6 in. Asphalt	478.5	0.5										
Dark gray, moist, silty clay with trace sand, gravel, and cinders (FILL)	475.5	3.5		1	SS	X	■		4-3-4	24.8		Ground surface elevation estimated from plans provided by client. Sample No. 5: Atterberg Limits: LL=60 PL=17 PI=43
Brown and gray, moist, medium stiff, SILTY CLAY (CL)	473.5	5.5	5	2	SS	X	■		3-3-4	22.8	3.5	
Light gray, moist, medium stiff, SILTY CLAY (CL)	471.0	8.0		3	SS	X	■		3-4-4	24.3	1.5	
Gray, moist, medium stiff, SILTY CLAY (CL) with trace sand	468.5	10.5	10	4	SS	X	■		3-2-4	16.5	1.5	
Gray, moist, soft, CLAY (CH)	465.5	13.5		5	SS	X	■		1-2-2	29.0	0.75	
Gray, moist, medium stiff, SILTY CLAY (CL) with some sand	464.0	15.0	15	6	SS	X	■		2-3-3	17.0	0.5	
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.1 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-117
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/5/22 Hammer Wt. 140 lbs.
 Date Completed 12/5/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 477												
15 in. Asphalt	476.6	0.4										
Gray, moist, silty clay with trace sand (FILL)	473.5	3.5		1	SS	X	█		7-5-3	19.4		Ground surface elevation estimated from plans provided by client. Sample No. 5: Atterberg Limits: LL=69 PL=19 PI=50
Brown, moist, medium stiff, SILTY CLAY (CL)	471.5	5.5	5	2	SS	X	█		4-4-5	24.3	2.25	
Gray, moist, medium stiff to soft, SILTY CLAY (CL)	466.5	10.5	10	3	SS	X	█		3-4-3	22.8	1.5	
	466.5	10.5	10	4	SS	X	█		3-2-3	23.5	1.5	
Brown, moist, soft, CLAY (CH)	463.5	13.5		5	SS	X	█		2-2-3	26.3	1.75	
Gray, moist, medium stiff, SILTY CLAY (CL) with some sand	462.0	15.0	15	6	SS	X	█		2-2-6	20.3	0.75	
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-118
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/7/22 Hammer Wt. 140 lbs.
 Date Completed 12/7/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 492												
6 in. Asphalt over 4 in. Brick	491.2	0.8										
Gray and dark gray, moist, silty clay (FILL)	488.5	3.5		1	SS	X	■		3-3-4	21.7		Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=41 PL=19 PI=22
Brown and gray, moist, soft, SILTY CLAY (CL)	486.5	5.5	5	2	SS	X	■		3-2-3	27.1	1.75	
Brown, moist, soft to medium stiff, SILTY CLAY (CL)				3	SS	X	■		2-2-3	20.3	1.5	
				4	SS	X	■		2-3-3	27.2	1.75	
Brown, moist, medium stiff, SILTY CLAY (CL) with trace sand and gravel	481.5	10.5	10	5	SS	X	■		2-3-4	21.6	2.0	
				6	SS	X	■		3-4-5	22.2	1.5	
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion 11.0 ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.0 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-119
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/7/22 Hammer Wt. 140 lbs.
 Date Completed 12/7/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 491												
4 in. Asphalt over 6 in. Brick	490.2	0.8										Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=48 PL=22 PI=26
Gray, moist, medium stiff, SILTY CLAY (CL)	488.0	3.0		1	SS	X			4-5-4	23.7		
Dark gray, moist, medium stiff, SILTY CLAY (CL)	485.5	5.5	5	2	SS	X			3-4-4	26.8	1.25	
Brown and gray, moist, soft, SILTY CLAY (CL)				3	SS	X			1-2-3	27.2	1.0	
				4	SS	X			1-2-2	23.2	1.0	
	480.0	11.0	10	5	SS	X			2-3-3	23.4	1.0	
Brown, moist, medium stiff, SILTY CLAY (CL) with trace sand	478.0	13.0		6	SS	X			3-2-3	24.9	1.0	
Gray and brown, moist, soft, SILTY CLAY (CL) with trace sand	475.5	15.5	15	7	SS	X			1-2-3	26.3	0.5	
Gray, moist, soft, SILTY CLAY (CL) with little sand and sandstone fragments	472.5	18.5										
Gray, moist, medium stiff, SILTY CLAY (CL) with trace sand and gravel	471.0	20.0	20	8	SS	X			5-4-5	18.0	1.5	
Bottom of Test Boring at 20.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 16.0 ft.
- ▽ At Completion 15.0 ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 16.8 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-120
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/20/22 Hammer Wt. 140 lbs.
 Date Completed 12/20/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 507												
7 in. Asphalt	506.4	0.6										Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=34 PL=22 PI=12
Brown, moist, medium stiff, SILTY CLAY (CL)				1	SS				6-4-5	27.3	1.75	
				2	SS				3-4-3	27.0	0.5	
			5	3	SS				3-3-3	19.7	1.75	
Brown, moist, medium stiff, SILTY CLAY (CL) with trace sand and gravel	499.0	8.0		4	SS				4-3-4	25.0	1.75	
- trace sandstone fragments below 11 ft.			10	5	SS				5-6-4	22.4	1.5	
				6	SS				4-4-6	20.5	1.5	
	491.0	16.0	15	7	SS				13-16-50/0.3	10.2		
Tan, weathered, SANDY SHALE	489.0	18.0		8	SS				50/0.2	8.0		
Tan, slightly weathered, SHALE			20	9	SS				50/0.3			
				10	SS				50/0.3			
			25	11	SS				50/0.3			
				12	SS				50/0.2			
Bottom of Test Boring at 30.0 ft.	477.0	30.0										

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 26.5 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-121
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/22 Hammer Wt. 140 lbs.
 Date Completed 12/6/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 512												
6 in. Asphalt	511.5	0.5										Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=36 PL=20 PI=16 Sample No. 5: Atterberg Limits: LL=75 PL=22 PI=53
Dark gray and gray, moist, silty clay with trace sand and gravel (FILL)	508.5	3.5		1	SS				3-3-4	21.6		
Brown, moist, very soft, SILTY CLAY (CL)	506.0	6.0	5	2	SS				2-1-2	25.5	0.25	
Brown, moist, medium stiff to stiff, SILTY CLAY (CL) with trace sand	501.5	10.5	10	3	SS				3-3-3	18.6	1.25	
Brown and gray, moist, medium stiff, CLAY (CH)	499.0	13.0	15	4	SS				3-5-6	24.3	2.25	
Tan and gray, severely weathered, SHALE	496.5	15.5	20	5	SS				3-4-6	23.3	1.5	
Tan, severely weathered, SHALE	494.0	18.0	25	6	SS				3-6-8	16.7	4.0	
Gray, weathered, SHALE	489.0	23.0		7	SS				7-9-12	28.2	2.5	
Brown, slightly weathered, SHALE	485.9	26.1		8	SS				14-16-27	15.8		
				9	SS				24-50/0.3	11.8		
Bottom of Test Boring at 26.1 ft.				10	SS				50/0.1			
				11	SS				50/0.1			

Sample Type
 SS - Driven Split Spoon
 ST - Pressed Shelby Tube
 CA - Continuous Flight Auger
 RC - Rock Core
 CU - Cuttings
 CT - Continuous Tube

Depth to Groundwater
 ● Noted on Drilling Tools 24.0 ft.
 ∇ At Completion 22.5 ft.
 ∇ After -- hours -- ft.
 ☒ Cave Depth 24.0 ft.

Boring Method
 HSA - Hollow Stem Augers
 CFA - Continuous Flight Augers
 CA - Casing Advancer
 MD - Mud Drilling
 HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-122
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/9/22 Hammer Wt. 140 lbs.
 Date Completed 12/9/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 509												
7 in. Asphalt	508.4	0.6										
Brown, moist, medium stiff, SILTY CLAY (CL)	506.0	3.0		1	SS				3-4-5	26.9	1.5	Ground surface elevation estimated from plans provided by client. Sample No. 2: Organic Content = 1.4% Marl Content = 15%
Gray, moist, soft, SILTY CLAY (CL) with little marl and trace organics	503.0	6.0	5	2	SS				3-2-3	26.3	1.0	
Brown, moist, medium stiff, SILTY CLAY (CL)				3	SS				3-3-3	20.8	1.25	
				4	SS				2-3-3	19.5	2.0	
Brown, slightly moist, stiff, SILTY CLAY (CL)	498.5	10.5	10	5	SS				5-6-7	23.4	2.75	
	496.0	13.0		6	SS				4-3-5	29.0	2.5	
Brown, slightly moist, medium stiff, SILTY CLAY (CL) with sandstone fragments	493.5	15.5	15	7	SS				7-7-9	20.4	3.5	
Gray, severely weathered, SHALE	490.2	18.8		8	SS				50/0.3	16.7		
Bottom of Test Boring at 18.8 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 16.0 ft.
- ∇ At Completion 17.0 ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 18.0 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-123
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/22 Hammer Wt. 140 lbs.
 Date Completed 12/6/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 507												
6 in. Asphalt	506.5	0.5										
Brown, moist, medium stiff, SILTY CLAY (CL)				1	SS				3-4-5	27.0	2.0	Ground surface elevation estimated from plans provided by client.
				2	SS				2-3-3	23.3	1.5	
			5	3	SS				2-3-4	18.4	1.5	
	499.0	8.0		4	SS				4-5-7	25.0	1.75	
Brown, slightly moist, stiff to very stiff, SILTY CLAY (CL) with trace sand and sandstone fragments			10	5	SS				5-6-7	18.7	2.0	
				6	SS				4-6-6	18.6	1.25	
			15	7	SS				6-8-12	14.6	2.5	
				8	SS				6-7-9	16.3	2.75	
Bottom of Test Boring at 20.0 ft.	487.0	20.0	20									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ▽ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 16.8 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-124
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/22 Hammer Wt. 140 lbs.
 Date Completed 12/6/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 518												
6 in. Asphalt	517.5	0.5										Ground surface elevation estimated from plans provided by client.
Brown, moist, medium stiff to soft, SILTY CLAY (CL)				1	SS	X			3-4-4	25.7	2.0	
				2	SS	X			3-4-4	23.7	1.5	
			5	3	SS	X			3-2-3	21.2	1.5	
				4	SS	X			2-3-4	19.1	2.25	
	507.5	10.5	10	5	SS	X			4-4-6	19.3	1.75	
Brown, moist, medium stiff, SILTY CLAY (CL) with little sand and sandstone fragments	505.0	13.0										
Gray and tan, severely weathered, SHALE	503.0	15.0	15	6	SS	X			5-6-8	18.3	3.5	
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.1 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-125
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/7/22 Hammer Wt. 140 lbs.
 Date Completed 12/7/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 515												
6 in. Asphalt	514.5	0.5										Ground surface elevation estimated from plans provided by client. Sample No. 1: Atterberg Limits: LL=40 PL=21 PI=19
Gray, moist, medium stiff, SILTY CLAY (CL)	512.0	3.0		1	SS				5-5-5	23.1	1.0	
Light brown, moist, soft, SILTY CLAY (CL)				2	SS				3-2-3	25.0		
	509.0	6.0	5	3	SS				3-4-5	20.0	2.5	
Brown, moist to very moist, stiff to very soft, SILTY CLAY (CL) with trace sand and sandstone fragments			10	4	SS				5-7-8	30.6	2.0	
				5	SS				5-5-6	45.0	2.0	
				6	SS				1-2-1	56.9		
Gray and tan, severely weathered, SHALE	499.0	16.0	15	7	SS				14-15-19	17.2	3.5	
Gray, weathered, SHALE	497.0	18.0	20	8	SS				12-15-20	13.6		
				9	SS				17-21-23	14.3		
				10	SS				15-27-50/0.3	11.9		
Gray, slightly weathered, SHALE	489.5	25.5	25	11	SS				50/0.3	5.7		
				12	SS				50/0.1			
				13	SS				50/0.3			
				14	SS				50/0.3	5.2		
				15	SS				50/0.3	7.2		
Bottom of Test Boring at 38.6 ft.	476.4	38.6		16	SS				50/0.1			

Sample Type
 SS - Driven Split Spoon
 ST - Pressed Shelby Tube
 CA - Continuous Flight Auger
 RC - Rock Core
 CU - Cuttings
 CT - Continuous Tube

Depth to Groundwater
 ● Noted on Drilling Tools None ft.
 ∇ At Completion None ft.
 ▼ After -- hours -- ft.
 ☒ Cave Depth 38.0 ft.

Boring Method
 HSA - Hollow Stem Augers
 CFA - Continuous Flight Augers
 CA - Casing Advancer
 MD - Mud Drilling
 HA - Hand Auger



CLIENT Town of Wheatland BORING # B-126
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/1/22 Hammer Wt. 140 lbs.
 Date Completed 12/1/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 501												
7 in. Asphalt	500.4	0.6										Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=34 PL=23 PI=11 Organic Content = 2.8%
Brown, moist, medium stiff, SILTY CLAY (CL)	498.0	3.0		1	SS				3-3-4	27.5	1.5	
Brown and dark gray, moist, medium stiff, SILTY CLAY (CL) with trace organics	495.0	6.0	5	2	SS				2-3-3	26.2	1.5	
Brown, moist, medium stiff to stiff, SILTY CLAY (CL) with trace sand	490.5	10.5	10	3	SS				2-3-4	20.1	1.5	
Brown and gray, moist, stiff, SILTY CLAY (CL) with trace sand and sandstone fragments	488.0	13.0	15	4	SS				5-6-6	20.7	1.75	
Brown, reddish brown, and gray, moist, stiff, SILTY CLAY (CL) with little sand, trace gravel, and sandstone fragments	485.5	15.5	20	5	SS				4-5-6	19.7	2.25	
Olive brown, severely weathered, SHALE	483.0	18.0	25	6	SS				5-6-9	21.8		
Brown, severely weathered, SHALE	480.5	20.5	30	7	SS				6-8-11	16.4		
Tan, weathered, SHALE	475.5	25.5		8	SS				5-7-7	35.9		
				9	SS				10-11-17	18.5		
				10	SS				14-21-35	15.1		
Gray, slightly weathered, SHALE				11	SS				50/0.1			
				12	SS				50/0.2			
Bottom of Test Boring at 32.0 ft.	469.0	32.0		13	SS				50/0.1		Auger refusal at 32.0 ft.	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 29.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-127
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 11/30/22 Hammer Wt. 140 lbs.
 Date Completed 11/30/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 490												
5 in. Asphalt over 12 in. Cinders	488.6	1.4										Ground surface elevation estimated from plans provided by client. Sample No. 2: Atterberg Limits: LL=58 PL=23 PI=35 Sample No. 3: Atterberg Limits: LL=37 PL=24 PI=13
Dark gray and black, moist, silty clay with little sand, trace gravel, cinders, and brick fragments (FILL)	486.5	3.5		1	SS				5-4-4	30.4		
Brown, moist, medium stiff, CLAY (CH)	484.5	5.5	5	2	SS				2-3-3	29.7	1.5	
Brown, moist, soft, SILTY CLAY (CL)				3	SS				2-2-2	31.0	0.75	
Brown, moist, medium stiff to soft, SILTY CLAY (CL)	481.5	8.5	10	4	SS				2-3-3	22.4	1.5	
				5	SS				2-2-3	20.5	2.0	
Brown and gray, moist, soft, CLAY (CH) with trace sand	477.0	13.0	15	6	SS				3-2-3	31.3	1.5	
Brown and gray, moist, very stiff, SILTY CLAY (CL) with trace sand and sandstone fragments	474.0	16.0		7	SS				5-7-10	17.3	3.0	
Brown and light gray, weathered, SHALE	472.0	18.0		8	SS				11-50/0.3	12.0		
Bottom of Test Boring at 19.3 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 18.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-128
 PROJECT NAME Proposed WWTP and Gravity Sewer System JOB # 170GC01517
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 11/30/22 Hammer Wt. 140 lbs.
 Date Completed 12/2/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 489												
8.5 in. Asphalt over 5 in. Cinders	487.8	1.2										Ground surface elevation estimated from plans provided by client.
Dark gray and brown, moist, silty clay with trace sand (FILL)	485.5	3.5		1	SS	X			3-2-2	26.0		
Brown, moist, soft to medium stiff, SILTY CLAY (CL)	478.5	5		2	SS	X			4-3-5	23.3	1.5	
				3	SS	X			3-2-3	18.9	1.5	
				4	SS	X			3-4-3	19.2	1.5	
Brown and gray, moist, medium stiff, SILTY CLAY (CL) with trace sand	478.5	10.5		5	SS	X			3-2-4	22.7	1.75	
				6	SS	X			4-4-5	22.0	1.0	
Brown, dark brown, and gray, severely weathered, SANDSTONE	476.0	13.0		7	SS	X			5-7-11	18.5	2.0	
				8	SS	X			6-10-50/0.3	16.3	3.0	
Brown, moist, very stiff, SILTY CLAY (CL) with trace sand and gravel - trace weathered sandstone fragments below 18 ft.	473.5	15.5		9	SS				50/0.1			
				10	SS				50/0.1	5.0		
Tan, slightly weathered, SHALE	468.5	20.5		11	SS				50/0.2			
				12	SS				50/0.1			
Gray, weathered, SHALE	458.5	30.5		13	SS				50/0.1	8.9		
				14	SS				50/0.1			
Bottom of Test Boring at 33.6 ft.	455.4	33.6										

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 28.0 ft.
- ∇ At Completion 23.0 ft.
- ∇ After -- hours -- ft.
- ⊠ Cave Depth 29.0 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-129
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/1/22 Hammer Wt. 140 lbs.
 Date Completed 12/1/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 486												
9 in. Asphalt	485.2	0.8										Ground surface elevation estimated from plans provided by client. Sample No. 1: Atterberg Limits: LL=37 PL=22 PI=15 Organic Content = 2.4% Sample No. 3: Atterberg Limits: LL=36 PL=19 PI=17
Black and dark gray, moist, medium stiff, SILTY CLAY (CL) with trace organics	482.5	3.5		1	SS				5-3-3	29.9	1.0	
Gray, moist, medium stiff, SILTY CLAY (CL)	480.5	5.5	5	2	SS				3-3-5	25.1	1.5	
Brown, gray, and dark gray, moist, soft, SILTY CLAY (CL)	477.5	8.5		3	SS				2-2-3	34.6	0.75	
Brown and gray, moist, medium stiff to soft, SILTY CLAY (CL)	473.0	13.0	10	4	SS				3-3-3	21.1	1.0	
Brown, moist, medium stiff, SILTY CLAY (CL) with trace sand	473.0	13.0		5	SS			●	3-2-3	23.1	1.75	
	468.0	18.0	15	6	SS			▽	3-2-4	23.9	1.0	
Gray and brown, moist, soft, SILTY CLAY (CL)	468.0	18.0		7	SS				5-4-5	25.1	1.5	
Dark gray and brown, slightly moist, very stiff, SILTY CLAY (CL) with little sand, trace gravel, and sandstone fragments	465.5	20.5	20	8	SS				3-2-2	25.5		
	461.0	25.0	25	9	SS			■	5-7-9	20.5	1.0	
Bottom of Test Boring at 25.0 ft.				10	SS				8-10-13	12.8	4.0	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 12.0 ft.
- ▽ At Completion 13.0 ft.
- ▼ After -- hours -- ft.
- Cave Depth 21.6 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-130
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/1/22 Hammer Wt. 140 lbs.
 Date Completed 12/1/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-tsf	Remarks
SURFACE ELEVATION 489												
7 in. Asphalt	488.4	0.6										
Black and dark gray, slightly moist, sandy silty clay with trace gravel (FILL)	485.5	3.5		1	SS	X	■		4-2-3	15.4		Ground surface elevation estimated from plans provided by client. Sample No. 3: Atterberg Limits: LL=30 PL=20 PI=10
Brown, moist, medium stiff to very soft, SILTY CLAY (CL)	478.5	10.5	5	2	SS	X	■		3-3-3	25.3	1.25	
				3	SS	X	■		1-1-2	21.6	1.0	
				4	SS	X	■		2-2-3	20.3	1.0	
Brown and gray, moist, medium stiff, SILTY CLAY (CL)	474.0	15.0	15	5	SS	X	■	█	3-3-4	23.6	1.25	
				6	SS	X	■		2-4-5	21.5	2.25	
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- █ Cave Depth 12.1 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland
 PROJECT NAME Proposed WWTP and Gravity Sewer System
 PROJECT LOCATION Wheatland, Indiana

BORING # B-131
 JOB # 170GC01517

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/1/22 Hammer Wt. 140 lbs.
 Date Completed 12/1/22 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector D. McIlwaine Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 486												
7 in. Asphalt	485.4	0.6										Ground surface elevation estimated from plans provided by client.
Brown and dark brown, moist, silty clay with trace sand and gravel (FILL)	482.5	3.5		1	SS				3-3-5	24.0		
Brown, moist, medium stiff, SILTY CLAY (CL)			5	2	SS				4-5-5	24.7	2.0	
				3	SS				4-4-6	19.5	2.5	
Brown and dark brown, moist, stiff, SILTY CLAY (CL) with trace sandstone fragments	478.0	8.0		4	SS				4-5-6	21.0		
Brown and gray, moist, stiff, SILTY CLAY (CL) with trace sandstone fragments	475.5	10.5	10	5	SS				5-5-8	20.9	2.0	
				6	SS				5-7-8	17.5	2.5	
Brown, moist, stiff, SILTY CLAY (CL)	470.5	15.5	15	7	SS				5-6-9	26.1	2.5	
	468.0	18.0		8	SS				1-2-2	23.0		
Brown and dark brown, moist, soft, SANDY SILTY CLAY (CL) with sandstone fragments	465.5	20.5	20	9	SS				1-1-3			
Tan, wet, very loose, SAND (SP-SM) with trace silt and gravel	463.0	23.0		10	SS				2-2-2			
Brown and dark brown, wet, very loose, SAND (SP-SM) with trace silt and gravel	460.0	26.0	25	11	SS				8-16-19	17.4		
Gray, slightly moist, hard, SILTY CLAY (CL) with trace sand and gravel				12	SS				10-15-16	16.2	2.5	
	453.0	33.0	30	13	SS				6-10-13	17.4	3.0	
Gray, slightly moist, hard, SILTY CLAY (CL) with trace sand	451.0	35.0	35	14	SS				9-14-19	14.0	3.0	
Bottom of Test Boring at 35.0 ft.												

Sample Type
 SS - Driven Split Spoon
 ST - Pressed Shelby Tube
 CA - Continuous Flight Auger
 RC - Rock Core
 CU - Cuttings
 CT - Continuous Tube

Depth to Groundwater
 ● Noted on Drilling Tools 20.0 ft.
 ∇ At Completion 26.0 ft.
 ∇ After -- hours -- ft.
 ☒ Cave Depth 28.2 ft.

Boring Method
 HSA - Hollow Stem Augers
 CFA - Continuous Flight Augers
 CA - Casing Advancer
 MD - Mud Drilling
 HA - Hand Auger



CLIENT Town of Wheatland BORING # B-1
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 495												
9 in. Asphalt	494.2	0.8										Ground surface elevation estimated based on Google Earth.
Brown, moist, soft, SILTY CLAY (CL)				1	SS				3-2-3	26.1	2.0	
	491.5	3.5										
Brown, very moist, medium stiff, CLAYEY SILT (ML)				2	SS				3-3-3	23.2	0.75	
	489.5	5.5	5									
Brown, dark brown, and gray, moist, medium stiff, SILTY CLAY (CL) with trace sand				3	SS				3-3-3	18.8	1.5	
			10									
				4	SS				2-3-3	19.7	1.5	
				5	SS				4-4-5	28.5	2.5	
				6	SS				3-3-6	23.1	2.5	
Bottom of Test Boring at 15.0 ft.	480.0	15.0	15									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 12.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-2
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 501												
4 in. Asphalt over 4 in. Cinders	500.3	0.7										Ground surface elevation estimated based on Google Earth.
Brown and gray, moist to very moist, medium stiff, SILTY CLAY (CL-ML)				1	SS				3-3-4	27.6		
				2	SS				3-3-3	25.4	0.5	Sample No. 2 driven on a rock.
	495.5	5.5	5									
Brown, very moist, medium stiff, CLAYEY SILT (ML)				3	SS				3-2-4	19.9	2.5	
				4	SS				2-3-3	19.1	1.5	
	490.5	10.5	10									
Brown and gray, very moist, soft, SILTY CLAY (CL)				5	SS				2-2-3	27.9	0.5	
	487.5	13.5										
Brown, black, and gray, moist, stiff, SILTY CLAY (CL)				6	SS				3-5-6		4.0	
	486.0	15.0	15									
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ▽ At Completion 12.4 ft.
- ▽ After -- hours -- ft.
- ⊠ Cave Depth 13.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-3
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 500												
10 in. Asphalt	499.2	0.8										
Brown and gray, moist, medium stiff to soft, SILTY CLAY (CL)				1	SS				5-3-3	27.5	1.5	Ground surface elevation estimated based on Google Earth.
				2	SS				3-1-3			
			5									
	494.0	6.0		3	SS				2-2-2	23.9	0.75	
Brown and gray, very moist, soft, CLAYEY SILT (ML)												
	491.5	8.5		4	SS				2-3-4	21.0	1.25	
Brown and gray, moist, medium stiff, SILTY CLAY (CL-ML)												
	490.0	10.0	10									Bottom of Test Boring at 10.0 ft.

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ▽ At Completion 7.8 ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 8.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-4
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 490												
7 in. Asphalt over 4 in. Cinders	489.1	0.9										Ground surface elevation estimated based on Google Earth.
Gray, moist, medium stiff, SILTY CLAY (CL)				1	SS				1-3-4	26.5		
	487.0	3.0										
Brown and gray, moist, medium stiff, SILTY CLAY (CL-ML)				2	SS				3-4-3	27.0	0.5	
	484.5	5.5	5									
Brown and gray, very moist, soft, CLAYEY SILT (ML)				3	SS				2-2-2	22.4	0.25	
				4	SS				2-2-3	18.3	0.5	
			10									
Reddish brown and dark brown, moist, medium stiff to stiff, SILTY CLAY (CL) with some sand	479.0	11.0		5	SS				2-3-4			
				6	SS				4-6-7			
Bottom of Test Boring at 15.0 ft.	475.0	15.0	15									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 8.5 ft.
- ▽ At Completion 12.0 ft.
- ▽ After -- hours -- ft.
- ⊠ Cave Depth 13.0 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-5
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 521												
12 in. Asphalt	520.0	1.0										Ground surface elevation estimated based on Google Earth.
Brown and reddish brown, moist, medium stiff, SILTY CLAY (CL-ML)				1	SS				4-4-5		1.5	
				2	SS				3-3-4		1.0	
	515.5	5.5	5									
Brown, moist, medium stiff, SILTY CLAY (CL-ML)				3	SS				3-4-6			
	512.5	8.5		4	SS				4-4-6		2.5	
Brown and gray, moist, medium stiff, SILTY CLAY (CL)			10									
	510.0	11.0		5	SS				4-6-6		3.5	
Brown and gray, moist, stiff, SILTY CLAY (CL)												
	507.5	13.5		6	SS				4-3-3			
Brown, moist, medium stiff, SILTY CLAY (CL) with little sand												
	506.0	15.0	15									
Bottom of Test Boring at 15.0 ft.												

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-6
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 494												
9 in. Asphalt over 14 in. Cinders				1	SS				9-9-7			Ground surface elevation estimated based on Google Earth.
Black and dark brown, moist, silty clay and cinders (FILL)	492.0	2.0										
Brown, very moist, soft, SILTY CLAY (CL-ML)	490.5	3.5		2	SS				3-2-3		0.25	
Brown, very moist, soft, CLAYEY SILT (ML)	488.5	5.5	5									
				3	SS				2-2-2		0.5	
	485.5	8.5		4	SS				2-3-4		1.0	
Brown and gray, moist, medium stiff to stiff, SILTY CLAY (CL)			10									
				5	SS				3-2-4		1.75	
				6	SS				4-5-6			
Bottom of Test Boring at 15.0 ft.	479.0	15.0	15									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.4 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-7
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 508												
5 in. Asphalt	507.6	0.4										Ground surface elevation estimated based on Google Earth.
Reddish brown and brown, moist, medium stiff, SILTY CLAY (CL) with little sand				1	SS				4-3-4	30.6		
	505.0	3.0										
Brown, very moist, medium stiff, CLAYEY SILT (ML)				2	SS				3-3-4	27.1	0.25	
	502.0	6.0	5									
Brown, moist, soft, SILTY CLAY (CL-ML)				3	SS				2-2-2	24.0	1.0	
	499.5	8.5										
Brown, moist, medium stiff, SILTY CLAY (CL)				4	SS				3-3-3		2.5	
	497.0	11.0	10									
Brown, black, and gray, moist, stiff to very stiff, SILTY CLAY (CL) with trace sand				5	SS				3-5-7		3.0	
	493.0	15.0	15									
Bottom of Test Boring at 15.0 ft.				6	SS				7-10-11		4.5+	

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 13.0 ft.
- ▽ At Completion 12.0 ft.
- ▽ After -- hours -- ft.
- ⊠ Cave Depth 13.4 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-8
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 485												
12 in. Asphalt	484.0	1.0										Ground surface elevation estimated based on Google Earth.
Dark gray, moist, medium stiff, SILTY CLAY (CL-ML) with trace organics	482.0	3.0		1	SS				7-7-3			
Brown and gray, moist, very soft to soft, SILTY CLAY (CL-ML)				2	SS				3-2-1	26.5	0.5	
			5									
				3	SS				2-2-3	21.2	1.0	
				4	SS				3-4-4	16.2	1.5	
Brown and gray, moist, medium stiff, SILTY CLAY (CL) with little sand	476.5	8.5										
			10									
				5	SS				3-3-5	22.6	2.75	
Brown, moist to very moist, medium stiff to stiff, SILTY CLAY (CL) with little to some sand	474.0	11.0										
				6	SS				5-6-6			
Bottom of Test Boring at 15.0 ft.	470.0	15.0	15									

Sample Type

Depth to Groundwater

Boring Method

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.2 ft.

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-9
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 484												
4 in. Asphalt over 6 in. Cinders	483.2	0.8										Ground surface elevation estimated based on Google Earth.
Dark gray, moist, soft, SILTY CLAY (CL-ML) with trace organics	481.0	3.0		1	SS				3-2-3			
Brown and gray, moist, medium stiff, SILTY CLAY (CL)	478.5	5.5	5	2	SS				3-4-4			
Brown and gray, moist, soft to very soft, SILTY CLAY (CL-ML)	478.5	5.5	5	3	SS				3-2-3		0.75	
				4	SS			▽	2-1-2		0.5	
Reddish brown and black, moist, medium stiff, SILTY CLAY (CL)	470.5	13.5	10	5	SS				1-2-2		0.25	
				6	SS				2-3-4		1.0	
Bottom of Test Boring at 15.0 ft.	469.0	15.0	15									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools 9.0 ft.
- ▽ At Completion 8.0 ft.
- ▽ After -- hours -- ft.
- ⊠ Cave Depth 12.0 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-10
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 486												
6 in. Asphalt	485.5	0.5										Ground surface elevation estimated based on Google Earth.
Brown and gray, moist, medium stiff, SILTY CLAY (CL-ML)				1	SS				5-3-3	27.0	1.5	
				2	SS				4-3-4	25.8	1.5	
			5									
Brown, moist, medium stiff, CLAYEY SILT (ML)	480.0	6.0		3	SS				3-3-4	27.2	0.5	
				4	SS				4-5-4	18.8		
Brown, moist, medium stiff, SILTY CLAY (CL-ML)	477.5	8.5										
			10									
Brown, black, and gray, moist, stiff, SILTY CLAY (CL)	475.0	11.0		5	SS				5-5-6	21.5	2.5	
				6	SS				4-4-3			
Brown and gray, moist, medium stiff, SILTY CLAY (CL) with little to some sand	472.5	13.5										
Bottom of Test Boring at 15.0 ft.	471.0	15.0	15									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 12.8 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-11
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 483												
9 in. Asphalt	482.2	0.8										Ground surface elevation estimated based on Google Earth.
Gray, moist, soft, SILTY CLAY (CL-ML)				1	SS				2-3-2	26.5		
	479.5	3.5										
Brown and gray, moist, medium stiff to soft, SILTY CLAY (CL)			5	2	SS				3-3-3	25.7	1.75	
				3	SS				2-2-2	25.6	0.75	
	474.5	8.5										
Brown, very moist, medium stiff, SILTY CLAY (CL) with trace to little sand				4	SS				4-4-5		0.25	
Bottom of Test Boring at 10.0 ft.	473.0	10.0	10									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 7.8 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger



CLIENT Town of Wheatland BORING # B-12
 PROJECT NAME Proposed Replacement Water Mains JOB # 170GC01308
 PROJECT LOCATION Wheatland, Indiana

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 12/6/21 Hammer Wt. 140 lbs.
 Date Completed 12/6/21 Hammer Drop 30 in.
 Drill Foreman G. Lauber Spoon Sampler OD 2.0 in.
 Inspector T. Struewing Rock Core Dia. -- in.
 Boring Method HSA Shelby Tube OD -- in.

SOIL CLASSIFICATION	Stratum Elevation	Stratum Depth, ft	Depth Scale, ft	Sample No.	Sample Type	Sampler Graphics	Recovery Graphics	Groundwater	Standard Penetration Test, Blows per 6 in. Increments	Moisture Content, %	Pocket Penetrometer PP-1sf	Remarks
SURFACE ELEVATION 490												
7 in. Asphalt over 4 in. Cinders	489.1	0.9										
Brown, moist, medium stiff, SILTY CLAY (CL) with trace sand	487.0	3.0		1	SS				3-4-4		2.0	Ground surface elevation estimated based on Google Earth.
Brown and gray, moist, medium stiff, SILTY CLAY (CL-ML)				2	SS				3-3-3		0.75	
			5									
				3	SS				3-3-4		2.0	
				4	SS				3-3-3		1.75	
			10									
Brown and gray, moist, medium stiff, SILTY CLAY (CL)	479.0	11.0		5	SS				4-3-4			
Brown, reddish brown, and gray, weathered, SHALE	476.5	13.5		6	SS				15-36-50			
Bottom of Test Boring at 15.0 ft.	475.0	15.0	15									

Sample Type

- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater

- Noted on Drilling Tools None ft.
- ∇ At Completion None ft.
- ▼ After -- hours -- ft.
- ⊠ Cave Depth 13.2 ft.

Boring Method

- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- CA - Casing Advancer
- MD - Mud Drilling
- HA - Hand Auger

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON-COHESIVE SOILS (Silt, Sand, Gravel and Combinations)

<u>Density</u>		<u>SPT*</u>	<u>Particle Size Identification</u>	
Very Loose	-	5 blows/ft or less	Boulders	- 8 inch or greater
Loose	-	6 to 10 blows/ft	Cobbles	- 3 to 8 inch
Medium Dense	-	11 to 30 blows/ft	Gravel	- Coarse - 1 to 3 inch
Dense	-	31 to 50 blows/ft		Medium - ½ to 1 inch
Very Dense	-	51 blows/ft or more		Fine - ¼ to ½ inch
			Sand	- Coarse 2.00mm to ¼ inch (dia. of pencil lead)
				Medium 0.42 to 2.00mm (dia. of broom straw)
				Fine 0.074 to 0.42mm (dia. of human hair)
			Silt	0.074 to 0.002mm (cannot see particles)

<u>Relative Proportions</u>	
Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS (Clay, Silt and Combinations)

<u>Consistency</u>		<u>SPT*</u>	<u>Plasticity</u>	
Very Soft	-	3 blows/ft or less	Degree of Plasticity	Plasticity Index
Soft	-	4 to 5 blows/ft	None to slight	0 - 4
Medium Stiff	-	6 to 10 blows/ft	Slight	5 - 7
Stiff	-	11 to 15 blows/ft	Medium	8 - 22
Very Stiff	-	16 to 30 blows/ft	High to Very High	over 22
Hard	-	31 blows/ft or more		

Classification on the logs are made by visual inspection of samples.

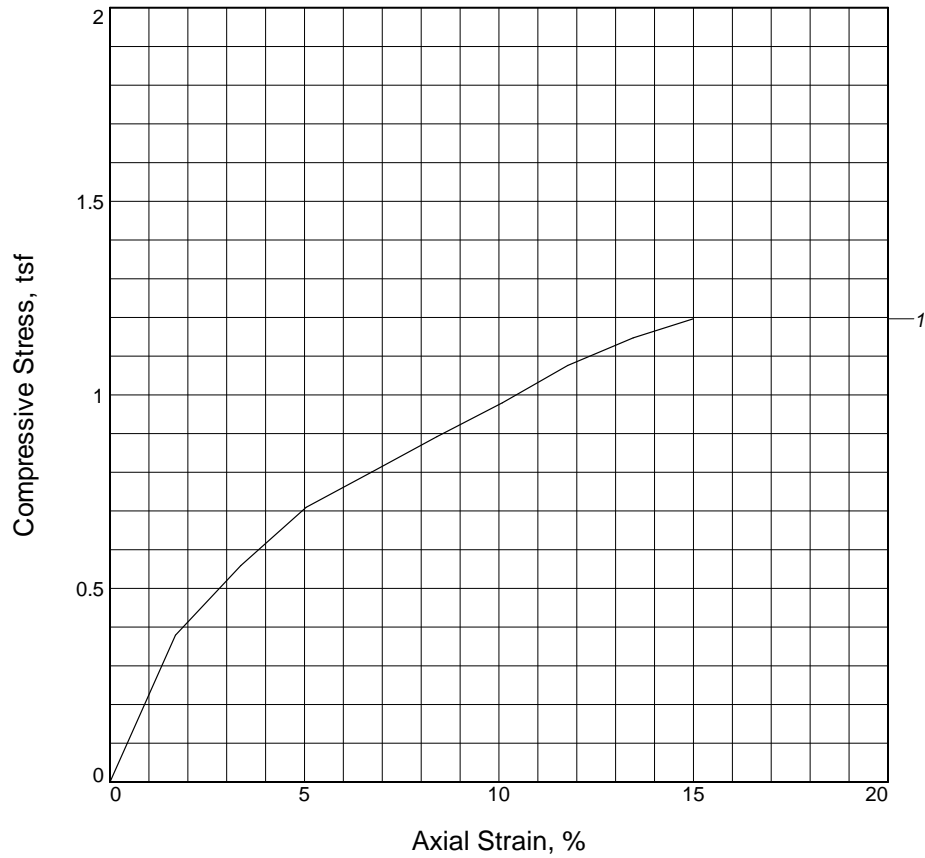
*Based upon results of Standard Penetration Test as described below.

Standard Penetration Test — Driving a 2.0" O.D. 1-3/8" I.D. sampler a distance of 12 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary for ATC to drive the split-barrel sampler 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the split-barrel sampler and making the test are recorded for each 6 inches of penetration of the sampler (Example – 6-8-9). The standard penetration test result can be obtained by adding the last two figures (i.e., 8 + 9 = 17 blows/ft). The Standard Penetration Test is performed according to ASTM D-1586-18.

Strata Changes — In the column "Soil Classifications" on the Test Boring Logs the horizontal lines represent strata changes. A solid line (_____) represents an actually observed change. A dashed line (_____) represents an estimated change.

Ground Water observations were made at the times and conditions indicated on the Test Boring Logs. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, tsf	1.197		
Undrained shear strength, tsf	0.598		
Failure strain, %	15.0		
Strain rate, %/min.	2.00		
Water content, %	22.1		
Wet density, pcf	128.8		
Dry density, pcf	105.5		
Saturation, %	99.8		
Void ratio	0.5978		
Specimen diameter, in.	1.38		
Specimen height, in.	2.97		
Height/diameter ratio	2.16		

Description:

LL = PL = PI = Assumed GS= 2.7 Type: Split spoon

Project No.: 170GC01517

Date Sampled:

Remarks:

Client: Town of Wheatland

Project: Sewer Improvements, Wheatland

Source of Sample: 14675 **Depth:** 6-7.5'

Sample Number: B-101; S-3

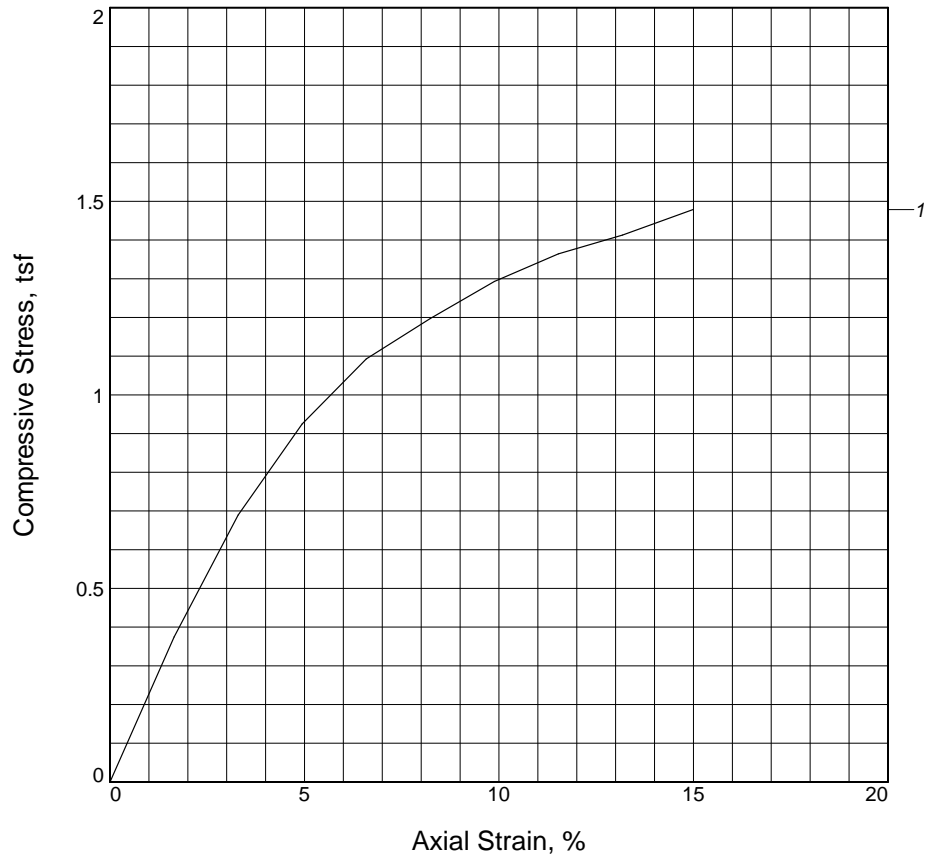
UNCONFINED COMPRESSION TEST

Atlas

Indianapolis, Indiana

Figure QU14675C

UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, tsf	1.479		
Undrained shear strength, tsf	0.739		
Failure strain, %	15.0		
Strain rate, %/min.	2.00		
Water content, %	17.9		
Wet density, pcf	133.9		
Dry density, pcf	113.6		
Saturation, %	99.9		
Void ratio	0.4838		
Specimen diameter, in.	1.43		
Specimen height, in.	3.04		
Height/diameter ratio	2.12		

Description:

LL = PL = PI = Assumed GS= 2.7 Type: Split spoon

Project No.: 170GC01517

Date Sampled:

Remarks:

Client: Town of Wheatland

Project: Sewer Improvements, Wheatland

Source of Sample: 14675 **Depth:** 38.5-40'

Sample Number: B-101; S-16

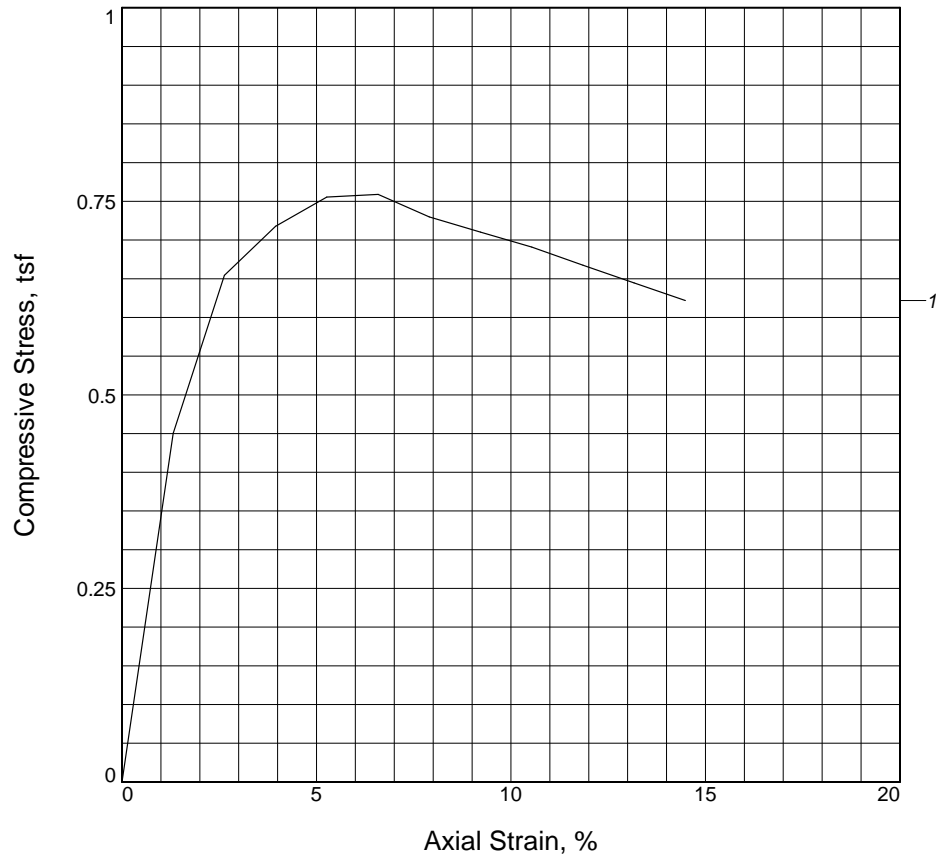
UNCONFINED COMPRESSION TEST

Atlas

Indianapolis, Indiana

Figure QU14675K

UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, tsf	0.759		
Undrained shear strength, tsf	0.379		
Failure strain, %	6.6		
Strain rate, %/min.	2.00		
Water content, %	23.1		
Wet density, pcf	124.3		
Dry density, pcf	100.9		
Saturation, %	93.1		
Void ratio	0.6697		
Specimen diameter, in.	1.35		
Specimen height, in.	3.04		
Height/diameter ratio	2.25		

Description:

LL = PL = PI = Assumed GS= 2.7 Type: Split spoon

Project No.: 170GC01517

Date Sampled:

Remarks:

Client: Town of Wheatland

Project: Sewer Improvements, Wheatland

Source of Sample: 14646 **Depth:** 6-7.5'

Sample Number: B-103; S-3

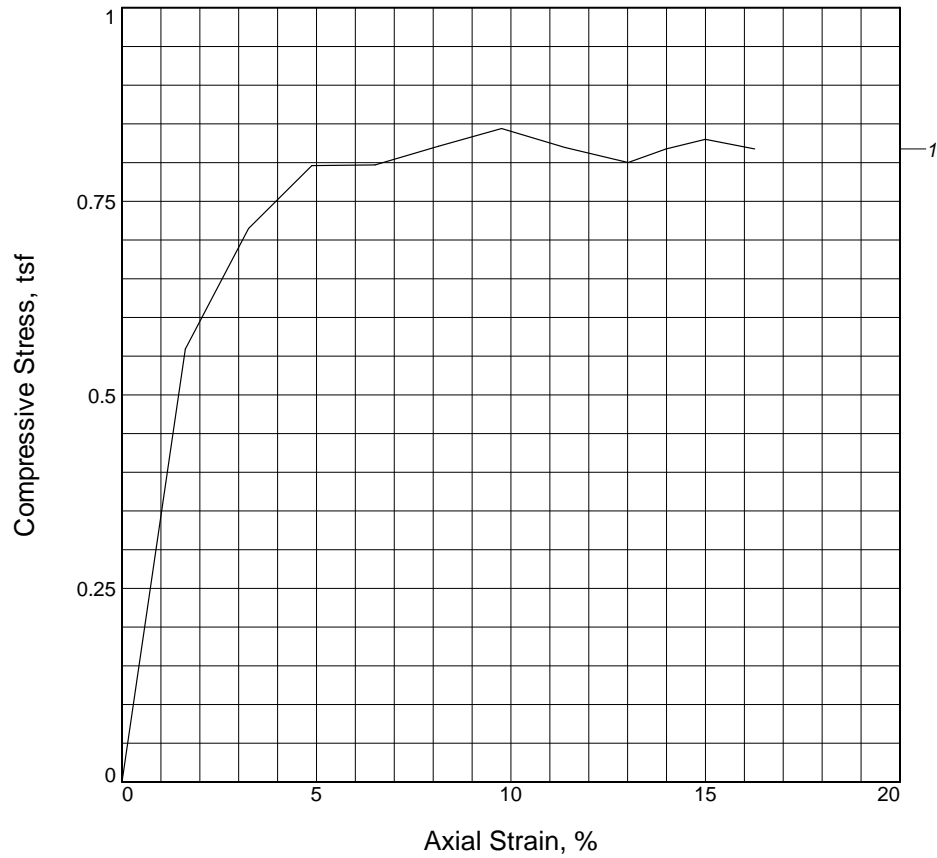
UNCONFINED COMPRESSION TEST

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Figure QU14646I

UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, tsf	0.844		
Undrained shear strength, tsf	0.422		
Failure strain, %	9.8		
Strain rate, %/min.	2.00		
Water content, %	31.3		
Wet density, pcf	119.9		
Dry density, pcf	91.3		
Saturation, %	100.0		
Void ratio	0.8461		
Specimen diameter, in.	1.33		
Specimen height, in.	3.07		
Height/diameter ratio	2.31		

Description:

LL = PL = PI = Assumed GS= 2.7 Type: Split spoon

Project No.: 170GC01517

Date Sampled:

Remarks:

Client: Town of Wheatland

Project: Sewer Improvements, Wheatland

Source of Sample: 14646 **Depth:** 11-12.5'

Sample Number: B-103; S-5

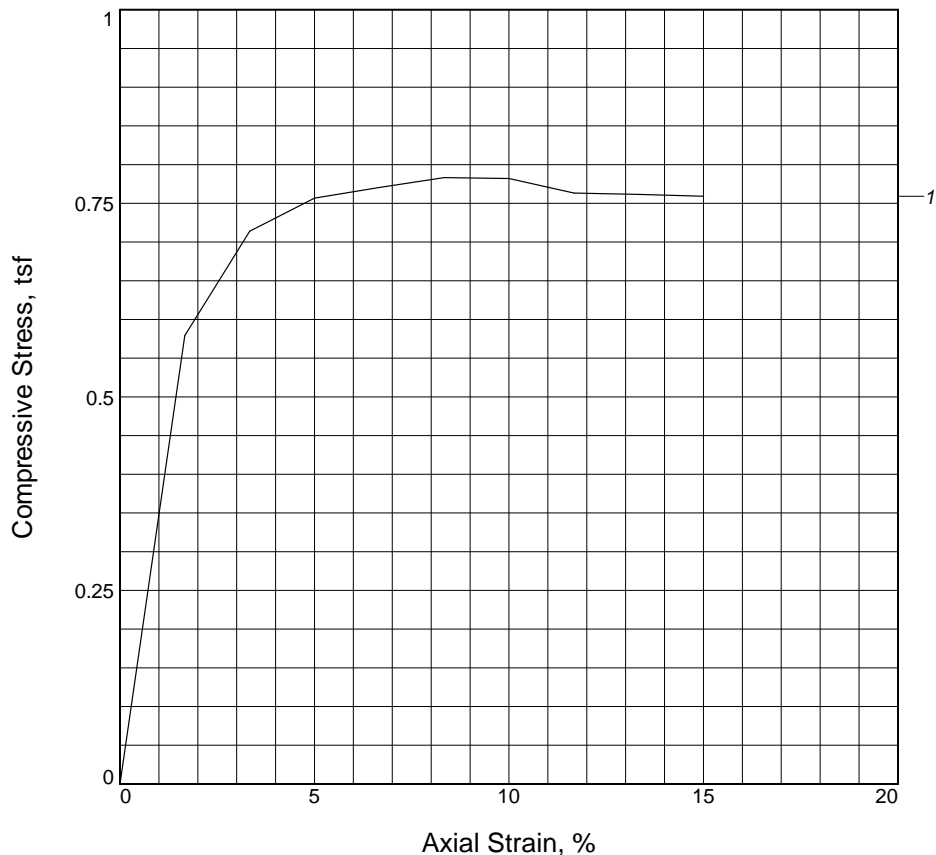
UNCONFINED COMPRESSION TEST

Atlas

Indianapolis, Indiana

Figure QU14646K

UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, tsf	0.783		
Undrained shear strength, tsf	0.392		
Failure strain, %	8.3		
Strain rate, %/min.	2.00		
Water content, %	28.2		
Wet density, pcf	121.3		
Dry density, pcf	94.6		
Saturation, %	97.5		
Void ratio	0.7822		
Specimen diameter, in.	1.38		
Specimen height, in.	3.00		
Height/diameter ratio	2.18		

Description:

LL = PL = PI = Assumed GS= 2.7 Type: Split spoon

Project No.: 170GC01517

Date Sampled:

Remarks:

Client: Town of Wheatland

Project: Sewer Improvements, Wheatland

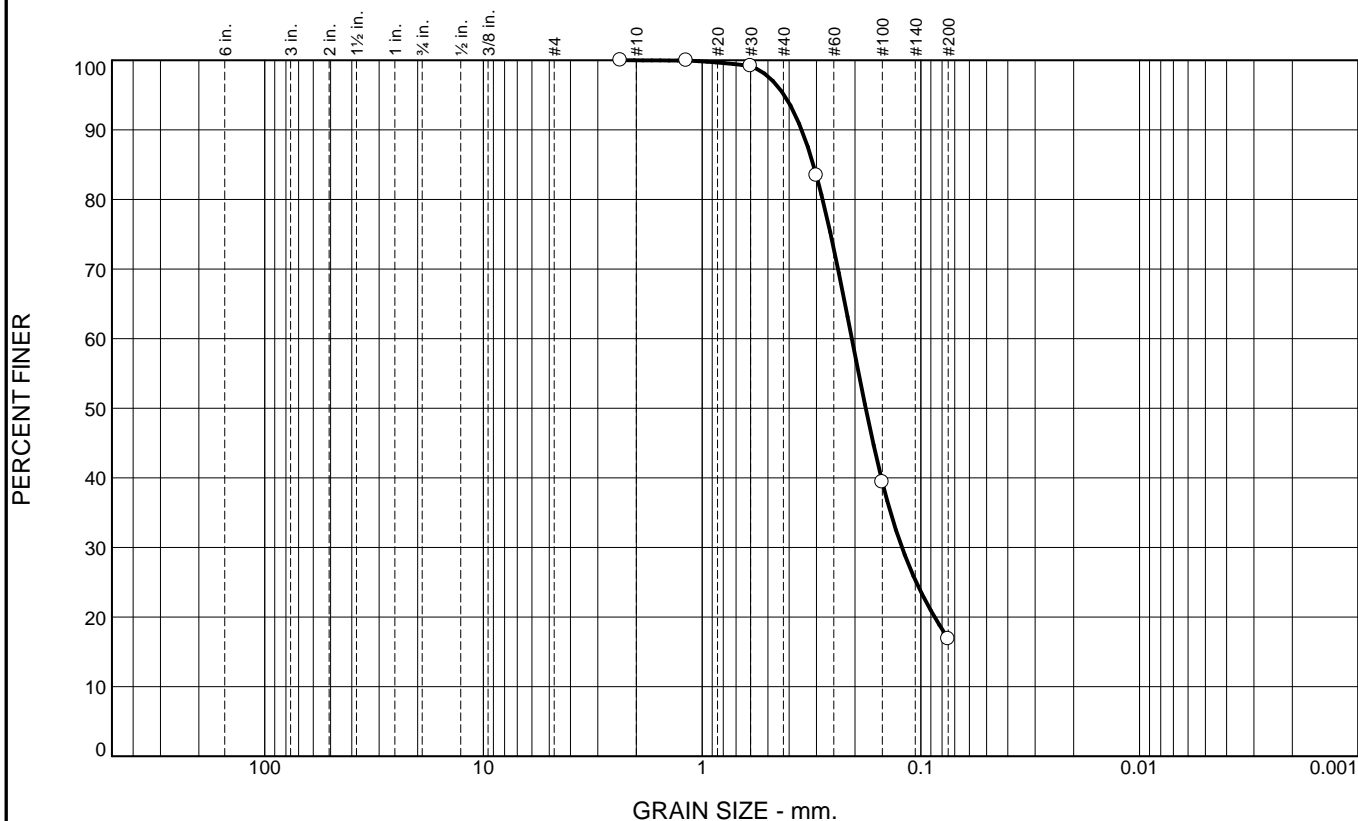
Source of Sample: 14646 **Depth:** 11-12.5'

Sample Number: B-104; S-5

UNCONFINED COMPRESSION TEST
Atlas
Indianapolis, Indiana

Figure QU14646S

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	4.8	78.3	16.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
#8	100.0		
#16	100.0		
#30	99.2		
#50	83.4		
#100	39.4		
#200	16.9		

Material Description

Silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D₉₀= 0.3508 D₈₅= 0.3099 D₆₀= 0.2067

D₅₀= 0.1785 D₃₀= 0.1220 D₁₅=

D₁₀= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

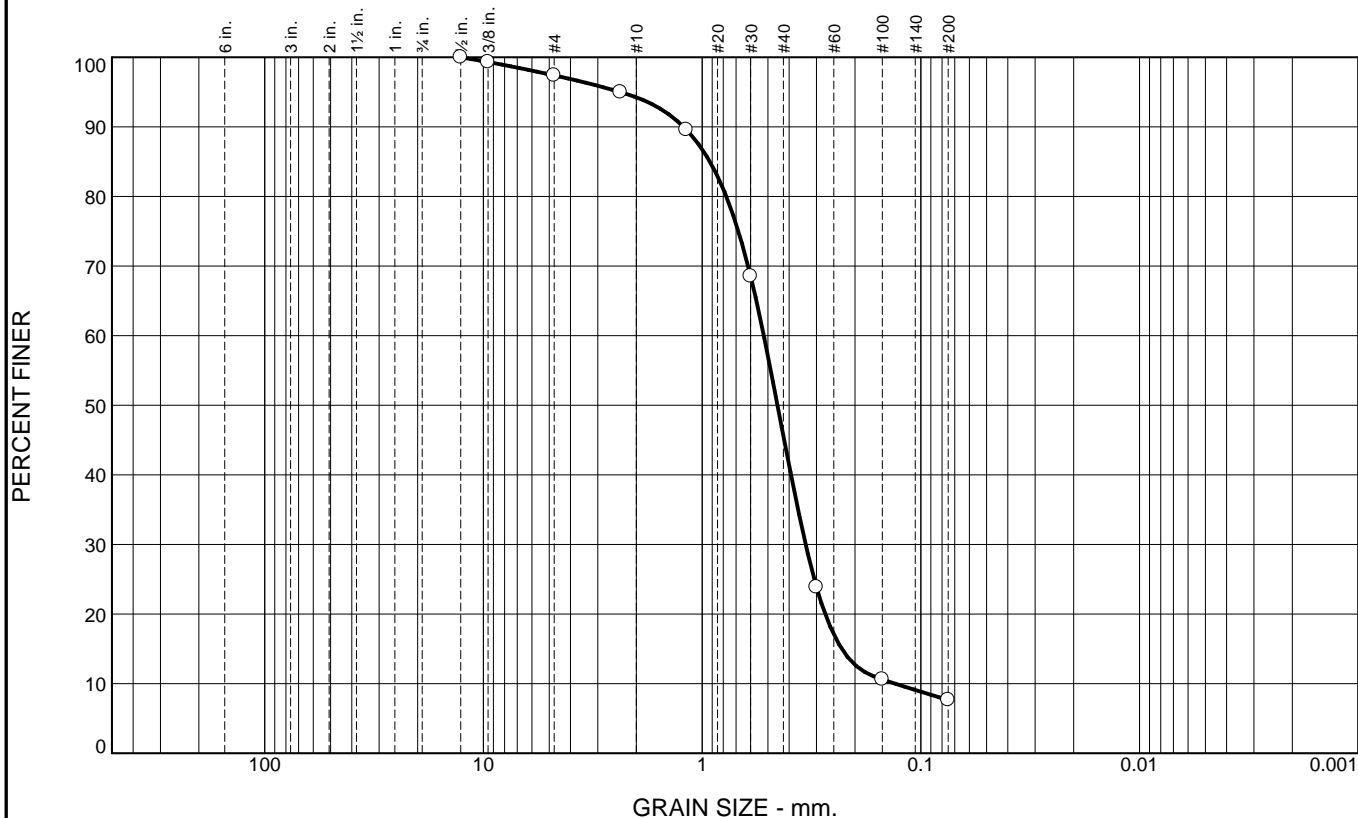
* (no specification provided)

Source of Sample: 14675 Depth: 18.5'-22.5'
 Sample Number: B-101; S-8&9

Date:

<p>Atlas</p> <p>Indianapolis, Indiana</p>	<p>Client: Town of Wheatland</p> <p>Project: Sewer Improvements, Wheatland</p> <p>Project No: 170GC01517</p>
<p>Figure</p>	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.6	3.2	48.6	37.9	7.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
1/2"	100.0		
3/8	99.3		
#4	97.4		
#8	95.0		
#16	89.6		
#30	68.5		
#50	23.9		
#100	10.6		
#200	7.7		

Material Description

Sand with trace Silt and Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D₉₀= 1.2158 D₈₅= 0.9211 D₆₀= 0.5224
D₅₀= 0.4522 D₃₀= 0.3362 D₁₅= 0.2299
D₁₀= 0.1309 C_u= 3.99 C_c= 1.65

Classification

USCS= SP-SM AASHTO=

Remarks

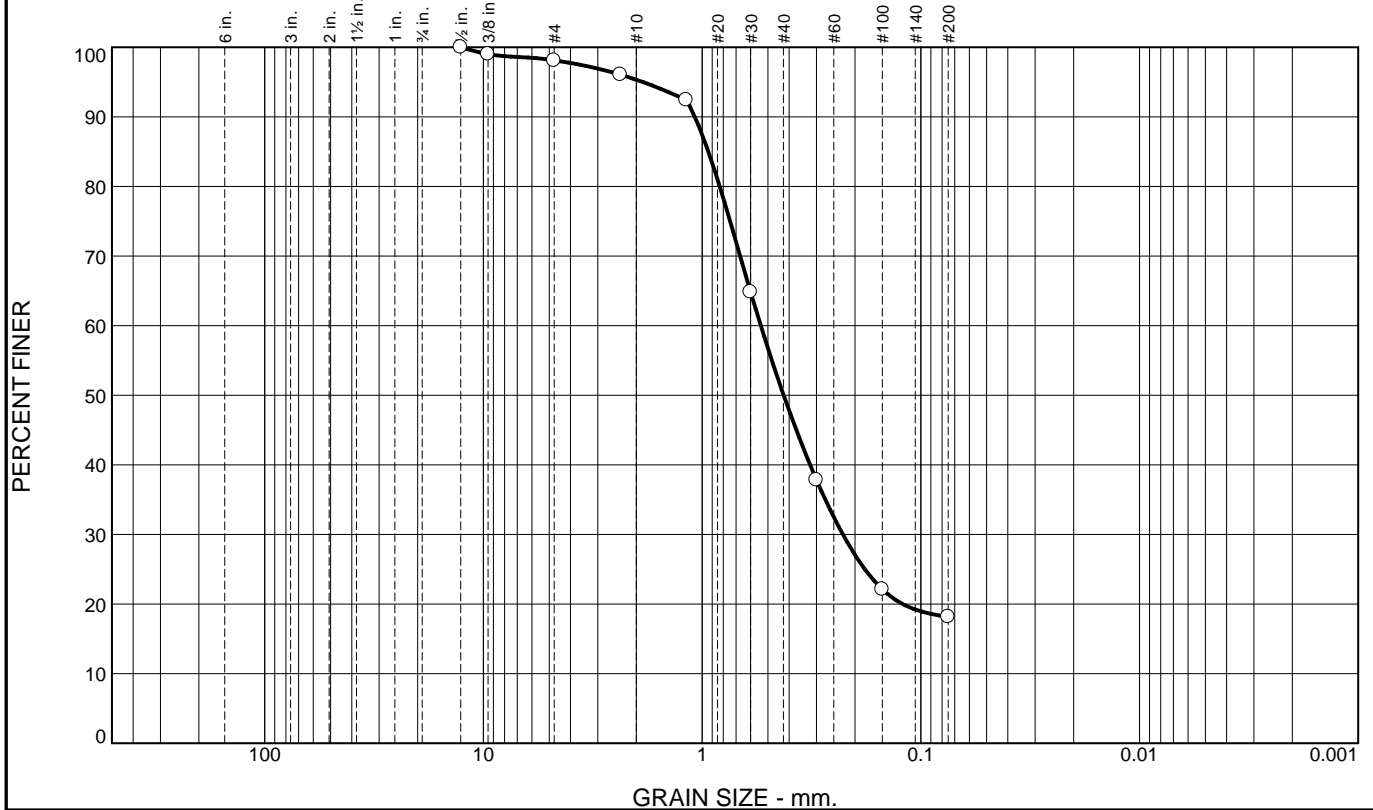
* (no specification provided)

Source of Sample: 14675 Depth: 23.5'-27.5'
Sample Number: B-101; S-10&11

Date:

<h2 style="margin: 0;">Atlas</h2> <h3 style="margin: 0;">Indianapolis, Indiana</h3>	<p>Client: Town of Wheatland</p> <p>Project: Sewer Improvements, Wheatland</p> <p>Project No: 170GC01517</p>
<p>Figure</p>	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.9	2.8	45.2	31.9	18.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
1/2	100.0		
3/8	99.0		
#4	98.1		
#8	96.1		
#16	92.4		
#30	64.8		
#50	37.8		
#100	22.1		
#200	18.2		

Material Description

Clayey Sand with trace Gravel

PL=	Atterberg Limits LL=	PI=
	Coefficients	
D ₉₀ = 1.0789	D ₈₅ = 0.9360	D ₆₀ = 0.5392
D ₅₀ = 0.4237	D ₃₀ = 0.2271	D ₁₅ =
D ₁₀ =	C _u =	C _c =
Classification		
USCS= SC AASHTO=		
Remarks		

* (no specification provided)

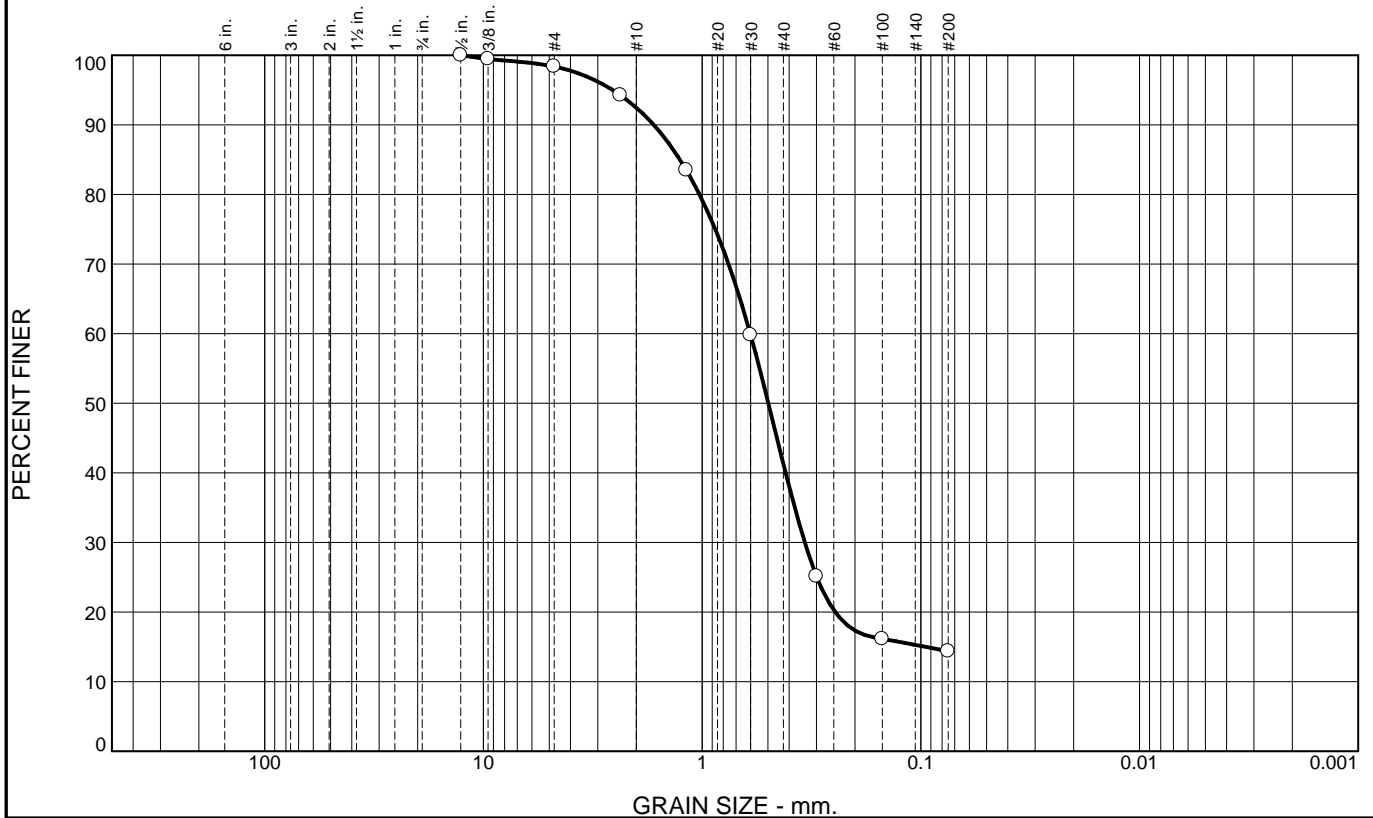
Sample Number: B-110; S-7 & 8

Depth: 16.0'-20.0'

Date:

<p style="font-size: 1.2em; margin: 0;">Atlas</p> <p style="font-size: 1.2em; margin: 0;">Indianapolis, Indiana</p>	<p>Client: Town of Wheatland</p> <p>Project: Sewer Improvements, Wheatland</p> <p>Project No: 170GC01517</p> <p style="text-align: right;">Figure</p>
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Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.6	5.9	51.2	26.9	14.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
1/2	100.0		
3/8	99.5		
#4	98.4		
#8	94.2		
#16	83.5		
#30	59.8		
#50	25.1		
#100	16.2		
#200	14.4		

Material Description

Clayey Sand with trace Gravel

PL= _____

Atterberg Limits

LL= _____ PI= _____

Coefficients

D₉₀= 1.6642 D₈₅= 1.2636 D₆₀= 0.6022
D₅₀= 0.4980 D₃₀= 0.3393 D₁₅= 0.0948
D₁₀= _____ C_u= _____ C_c= _____

USCS= SC **Classification**
AASHTO= _____

Remarks

* (no specification provided)

Source of Sample: 14647 Depth: 13.5'-15.0'
Sample Number: B-111; S-6

Date: _____

<h2 style="margin: 0;">Atlas</h2> <h3 style="margin: 0;">Indianapolis, Indiana</h3>	<p>Client: Town of Wheatland</p> <p>Project: Sewer Improvements, Wheatland</p> <p>Project No: 170GC01517</p>
<p>Figure _____</p>	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.2	8.4	44.3	30.7	8.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
3/4	100.0		
1/2	97.6		
3/8	96.6		
#4	91.8		
#8	85.4		
#16	75.9		
#30	58.5		
#50	20.7		
#100	10.6		
#200	8.4		

Material Description

Sand with trace Silt and Gravel

PL=	Atterberg Limits	PI=
	LL=	
	Coefficients	
D ₉₀ = 3.8417	D ₈₅ = 2.2865	D ₆₀ = 0.6201
D ₅₀ = 0.5101	D ₃₀ = 0.3638	D ₁₅ = 0.2489
D ₁₀ = 0.1197	C _u = 5.18	C _c = 1.78
Classification		
USCS= SP-SM		AASHTO=
Remarks		

* (no specification provided)

Source of Sample: 14650
 Sample Number: B-131; S-9

Depth: 21.0'-22.5'

Date:

<h2 style="margin: 0;">Atlas</h2> <h3 style="margin: 0;">Indianapolis, Indiana</h3>	<p>Client: Town of Wheatland</p> <p>Project: Sewer Improvements, Wheatland</p> <p>Project No: 170GC01517</p> <p style="text-align: right;">Figure</p>
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Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.8	3.5	34.3	52.0	7.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
3/4	100.0		
1/2	99.7		
3/8	99.1		
#4	97.2		
#8	94.1		
#16	90.6		
#30	82.6		
#50	32.9		
#100	10.0		
#200	7.4		

Material Description

Sand with trace Silt and Gravel

PL=	Atterberg Limits	PI=
	LL=	
	Coefficients	
D ₉₀ = 1.1036	D ₈₅ = 0.7098	D ₆₀ = 0.4282
D ₅₀ = 0.3782	D ₃₀ = 0.2862	D ₁₅ = 0.1984
D ₁₀ = 0.1503	C _u = 2.85	C _c = 1.27
Classification		
USCS= SP-SM		AASHTO=
Remarks		

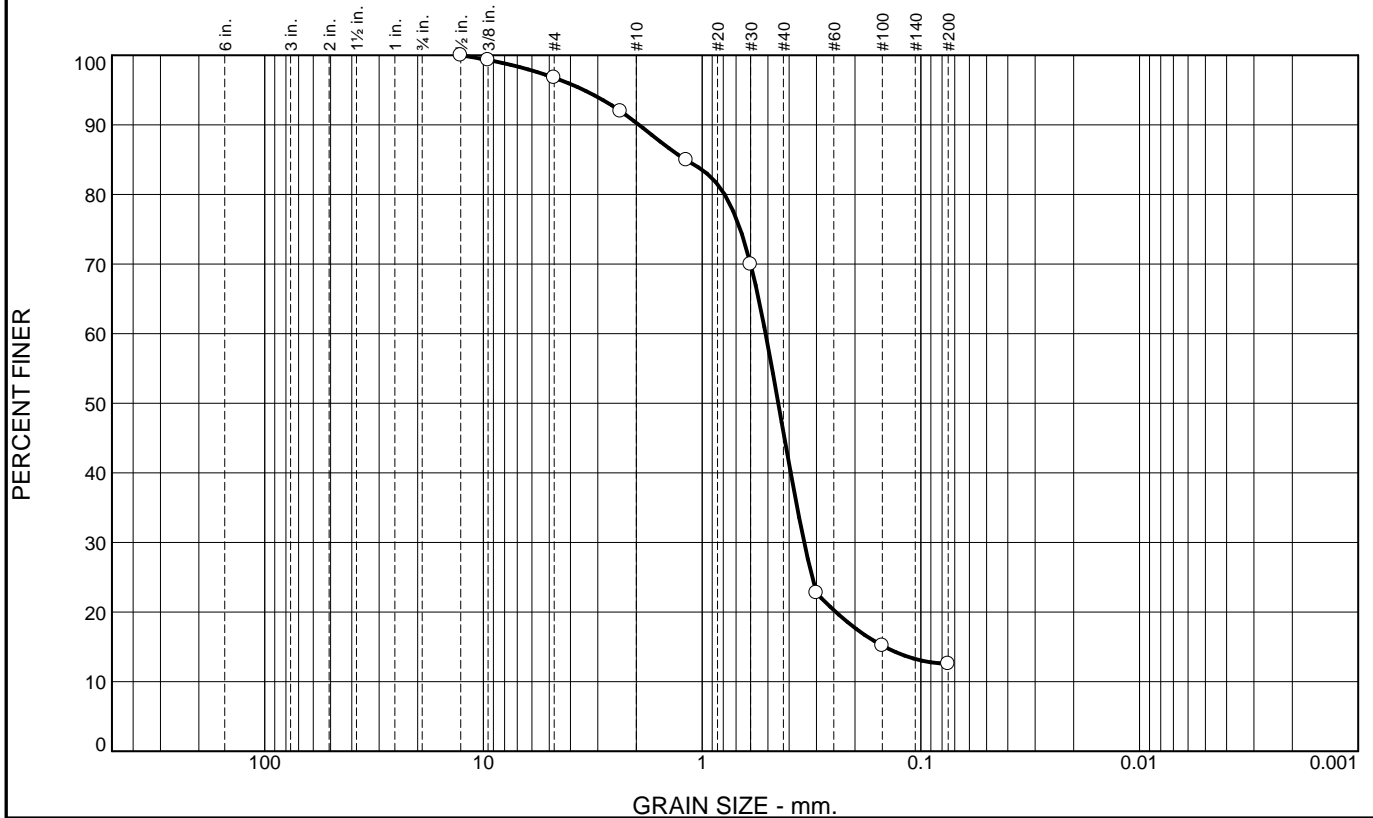
* (no specification provided)

Source of Sample: 14650 **Depth:** 23.5'-25.0'
Sample Number: B-131; S-10

Date:

<h2 style="margin: 0;">Atlas</h2> <h3 style="margin: 0;">Indianapolis, Indiana</h3>	<p>Client: Town of Wheatland</p> <p>Project: Sewer Improvements, Wheatland</p> <p>Project No: 170GC01517</p>
<p>Figure</p>	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.2	6.5	44.4	33.3	12.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X-NO)
1/2	100.0		
3/8	99.3		
#4	96.8		
#8	92.0		
#16	84.9		
#30	70.0		
#50	22.8		
#100	15.2		
#200	12.6		

Material Description

Silty Sand with trace Gravel

Atterberg Limits

PL= _____ LL= _____ PI= _____

Coefficients

D₉₀= 1.9443 D₈₅= 1.1895 D₆₀= 0.5125
 D₅₀= 0.4483 D₃₀= 0.3415 D₁₅= 0.1462
 D₁₀= _____ C_u= _____ C_c= _____

Classification

USCS= SM AASHTO= _____

Remarks

* (no specification provided)

Source of Sample: 14650 **Depth:** 16.0'-20.0'
Sample Number: B-132; S-7 & 8

Date: _____

<p style="font-size: 1.2em; margin: 0;">Atlas</p> <p style="font-size: 1.2em; margin: 0;">Indianapolis, Indiana</p>	<p>Client: Town of Wheatland</p> <p>Project: Sewer Improvements, Wheatland</p> <p>Project No: 170GC01517</p>
<p>Figure _____</p>	

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBC-Member geotechnical engineer for more information.



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