

**SPECIFICATIONS
AND
CONTRACT DOCUMENTS**

FOR

TANK HILL WATER FACILITY IMPROVEMENTS

**OWNER BID #1704WD
ENGINEER PROJECT #DAD003**



FOR THE CITY OF DADE CITY

**June 2018
Revised March 2020**

CITY COMMISSION

Mayor Camille Hernandez
Mayor Pro-tem Eunice M. Penix
Commissioner Scott Black
Commissioner James D. Shive
Commissioner Nicole Deese Newlon

City Manager: Leslie Porter
Utilities Manager: Jay Sheridan



"This is to certify to the best of my belief and knowledge that these Specifications and Contract Documents entitled, "Tank Hill Water Facility Improvements" represent sound engineering principles and the design information is consistent with the applicable

requirements of the Florida Administrative Code.”

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DATED JUNE 29, 2018

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INVITATION TO BID

Tank Hill Water Facility Improvements

Bid Number: 1704WD

The City of Dade City is requesting competitive sealed bids for the Tank Hill Water Facility Improvements, a project including: *(1) installation of a new water supply well approximately 500 feet in depth; (2) installation of a new deep well vertical turbine pump with associated piping, appurtenances and well pad; (3) new elevated storage tank; (4) two new booster pumps and hydropneumatic tank; (5) new sodium hypochlorite feed system; (6) miscellaneous site work; and (7) electrical and instrumentation modifications.*

The City will receive sealed bids until 2:00 p.m., local time (our clock) on Friday, May 1, 2020, in City Hall, 38020 Meridian Avenue, Dade City, Florida. Bids received after this will not be accepted. Bids will be publicly opened and read immediately thereafter in the Commission Chambers. All interested parties are invited to attend. Bidders shall submit one original bid form.

Insurance coverage is required for this project: please refer to the Special Provisions.

A mandatory pre-bid meeting will be held at 10:00 a.m. on Tuesday, April 14, 2020, at the City of Dade City Commission Chambers, 38020 Meridian Avenue. A site visit will be allowed immediately following the meeting. Bidders may submit questions in writing only before 5:00 pm on Tuesday, April 21, 2020. The City will not respond to questions submitted after that time.

The bid must be submitted on the prescribed Bid form. The successful Bidder will be required to furnish the necessary bond(s) for the faithful performance of the Contract, as prescribed in the Bid Documents.

Contractor shall possess the following current licenses and certifications:

- 1) Florida General Contractor's License

Lowest bid contractor shall submit to the City copies of the required licenses and certifications within 3 business days following the bid opening.

All Bonds, Insurance Contracts, and Certificates of Insurance shall be either executed by or countersigned by a licensed resident agent of the Surety or insurance company having his place of business in the State of Florida. Further, said Surety or insurance company shall be duly licensed and qualified to do business in the State of Florida.

Each bid shall also be accompanied by a properly completed and executed copy of the "Certification under section 287.087, Florida Statutes, of a Drug-Free Workplace". In case of tie bids, preference will be given to Bidders submitting the certification with their bids certifying that they have a drug-free workplace.

In order to perform public work, the successful Bidder shall, as applicable, hold or obtain such Contractor's and Business Licenses as required by State Statutes.

Before a Contract will be awarded for the work contemplated herein, the Owner shall conduct such investigations as are necessary to determine the performance record and ability of the apparent low Bidder to perform the size and type of work specified under this Contract. Upon request, the Bidder shall submit such information as deemed necessary by the Owner to evaluate the Bidder's qualifications.

Bid documents, in electronic format, may be downloaded from Demandstar or purchased from the City of Dade City, in the amount of twenty dollars per copy (plus shipping), non-refundable. All checks shall be made out to City of Dade City. Only complete sets of documents will be distributed, no partial sets.

Bid documents may be viewed at the following location by appointment:

City of Dade City
38020 Meridian Avenue
Dade City, FL 33525
Phone: 352-523-5050

The right is reserved to reject all bids or any bid not conforming to the intent and purpose of the Contract Documents, and to postpone the award of the Contract for a period of time which, however, shall not extend beyond one hundred twenty days from the bid opening date.

Envelope must be identified as follows:

NAME OF ITEM BEING BID: Tank Hill Water Facility Improvements

BID NO.: 1704WD

OPENING DATE: May 1, 2020 @ 2:00 p.m.

We look forward to receiving your response.

Abu Nazmurreza
Public Works Director
City of Dade City

IMPORTANT! —PLEASE READ CAREFULLY BEFORE MAKING BID GENERAL PROVISIONS

These general terms and conditions apply in like force to this solicitation and to any contract resulting therefrom.

ACKNOWLEDGMENT OF AMENDMENTS

Bidders shall acknowledge receipt of any amendment to the solicitation by identifying the amendment number in the space provided for this purpose on the bid form, by letter, or by returning a copy of the issued amendment with the submitted bid. The acknowledgment should be received by City of Dade City by the time and at the place specified for the receipt of bids. Failure to acknowledge an issued amendment may result in bid rejection and disqualification.

ALTERNATIVE BIDS

The bidder **WILL NOT** be allowed to offer more than one price (for the goods or services specified). If the said bidder should submit more than one price on any item (or service), **ALL** prices will be rejected for that item. The bidders offering service delivery methods other than those permitted by the scope of work or specifications may submit a separate envelope clearly marked "Alternative Bid." Alternative bids will be deemed nonresponsive and will not be considered for award. All such responses will, however, be examined prior to award. Such examination may result in cancellation of all bids received to permit rewriting the scope of work or specifications to include the alternative method, or the alternative method may be considered for future requirements of the City of Dade City.

APPLICABLE LAW

The contract shall be governed in all respects by the laws of the State of Florida, and any litigation with respect thereto shall be brought in the courts of Pasco County, Florida. The contractor shall comply with all applicable Federal, State, and local laws and regulations. Lack of knowledge by the bidder will in no way be a cause for relief from responsibility.

ASSIGNMENT

The contractor shall not assign, transfer, convey, sublet, or otherwise dispose of any award or any or all of its rights, title, or interest therein, or delegate the duties hereunder without the prior written consent of the City of Dade City.

AWARD

Consideration for award will be by proximity to specifications given, costs, time of delivery, and other factors deemed by the City to be appropriate. All purchases, leases, or contracts that are based on competitive bids will be awarded to the lowest, responsive, and responsible bidder. Complete and accurate responses to all items are necessary for the complete and fair evaluation of bids. In determining the responsibility of vendors, past performance, references, documented experience, financial capability, and other reasonable factors may be considered. The City of Dade City reserves the right to segment the work and award in a manner that is deemed to be in the City's best interest.

BIDDER CERTIFICATION

The bidder agrees that submission of a signed bid form is certification that the bidder will accept an award made to it as a result of the submission.

BID ACCEPTANCE PERIOD

Any bid submitted as a result of the solicitation shall be binding on the bidder for a minimum of one hundred twenty calendar days following the bid opening date. Any bid for which the bidder specifies a shorter acceptance period may be rejected.

BID CLARIFICATIONS

If any party contemplating the submission of a bid on this invitation is in doubt as to the true meaning of any part of the plans, specifications, or other documents, he should submit a written request for an interpretation. Questions or requests for interpretations shall clearly state, in detail, the basis for such question(s) or request(s) including a reference to the specific paragraph or language in the solicitation. The request shall be clearly marked as a "PREBID QUESTION" and must include the solicitation number. Modifications to solicitations will be made only by properly issued written addenda. All such addenda shall become part of the solicitation and resulting contract documents. The City of Dade City shall only be responsible for explanations or interpretations that are issued in accordance herewith. No oral interpretations will be made as to the meaning of specifications or any other contract documents. Failure to comply with this provision will result in the bidder waiving his/her right to dispute the bid specification.

BIDDER INVESTIGATIONS

Before submitting a bid, each bidder shall make all investigations and examinations necessary to ascertain all site conditions and requirements affecting the full performance of the contract and to verify any representations made by City of Dade City upon which the bidder will rely. If the bidder receives an award as a result of its bid submission, failure to have made such investigations and examinations will in no way relieve the bidder from its obligation to comply in every detail with all provisions and requirements of the contract documents, nor will a plea of ignorance of such conditions and requirements be accepted as a basis for any claim whatsoever by the contractor for additional compensation.

BID ENVELOPES

Envelopes containing bids must be sealed and marked in the lower left-hand corner with the invitation number, commodity, and date and hour of opening of bids. Failure to do so may cause bid not to be considered. Express Company or Express Mail envelopes containing a sealed bid shall also be sealed and should be clearly marked with the invitation number, commodity, and date and hour of opening of bids. Failure to clearly mark envelopes may delay delivery and render the response late.

BID FORM SUBMISSION

Bids shall be submitted on the attached forms. Bids concerning separate bid invitations must not be combined on the same form or placed in the same envelope. Bids submitted in violation of this provision shall not be considered. All bids must be signed, in ink, in order to be considered. Erasures are not acceptable on bids; if necessary to make a change, strike out or draw a line through

incorrect item and type the correction above, and initial the correction in ink. If the bidder is a firm or corporation, the bidder must show the title of the individual executing the bid, and if the individual is not an officer of the firm or corporation, the bidder must submit proof that the individual has the authority to obligate the firm or corporation. BIDS MAY NOT BE ALTERED OR AMENDED AFTER THE BID CLOSING.

BID RECEIPT AND OPENING

The City of Dade City will receive sealed bid proposals until date and time indicated on bid cover. Bids must be delivered, by hand or mail, to the City of Dade City 38020 Meridian Avenue, Dade City, Florida, where they will be opened at the stated time. Bids must be time stamped in the Public Works Department before or on the hour and date indicated on the cover sheet (Invitation for Bid) for the bid opening. Bids received after the date and time of the bid opening will be received, date stamped, and returned to the bidder unopened. It is the responsibility of the bidder to ensure that bids arrive at the designated opening place on time. Late or non-delivery due to mail or express delivery company failure will not be considered adequate reason for consideration of late bids. FAXED BIDS WILL NOT BE ACCEPTED AND SHALL NOT BE CONSIDERED FOR EVALUATION OR AWARD. Notes may be taken at the public reading of the bid(s) at the specified time and date of the opening or a personal inspection may be made of the bid(s) after award has been made and documents are placed in central and public files.

BID SECURITY

Bid Security will be submitted and shall be made payable to the City of Dade City, in an amount of not less than five percent (5%) of the Bidder's Contract Price and in the form of a certified or cashier's check or a Bid Bond issued by a Surety company considered satisfactory by the City and authorized to transact business in the State of Florida. The Bid Bond shall be issued by a company having a registered agent in the State of Florida. Personal checks are not acceptable. The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required payment and performance bonds, whereupon the Bid Security will be returned. If the Successful Bidder fails to furnish the qualifications submittals or fails to execute and deliver the Agreement and furnish the required Bonds within ten (10) days of the Notice of Award, City may annul the Notice of Award and the Bid Security of that Bidder will be forfeited. The Bid Security of any Bidder whom City believes to have a reasonable chance of receiving the award may be retained by City until the ninety-first (91st) day after the Bid opening. Bid Security of other Bidders will be returned approximately seven (7) days after the Bid opening.

EXECUTION OF WRITTEN CONTRACT

The Bidder receiving from the City a Notice of Intent to Recommend Award will be required to sign and submit to the City, within ten days after the issuance of said notice, a written agreement that will be provided by the City. Said written agreement will evidence in written form the contract to be made by the City following award by the City Commission to the successful Bidder. The contract shall be contingent upon the timely provision by the Bidder to the City of all documentation required by these contract documents, and may be unilaterally terminated by the City for cause upon failure of the Bidder to supply said bonds and other documentation within the time frames set forth in the contract documents.

PERFORMANCE BOND AND PAYMENT BOND

A Performance Bond and Payment Bond will be required regardless of the awarded amount of this Agreement.

The Performance Bond shall be issued in a sum equal to one hundred percent of the total awarded contract amount by a surety company considered satisfactory by the City and authorized to transact business in the State of Florida, and shall be provided by the successful Bidder for purposes of insuring the faithful performance of the obligations imposed by the resulting contract. The Payment Bond shall be issued in a sum equal to one hundred percent of the total awarded contract amount by a surety company considered satisfactory by the City and authorized to transact business in the State of Florida and shall be provided by the successful Bidder for purposes of protecting the City from lawsuits for non-payment of debts as might be incurred during the performance by the successful Bidder under such contract. The Performance Bond and Payment Bond forms must be properly executed by the surety company and the successful Bidder and submitted to the City staff within ten days after issuance of Notice of Intent to Recommend Award by the City Manager. In lieu of the bonds required by this section, the successful Bidder may file with the City an alternative form of security that shall be in the form of cash, money order, certified check, cashiers' check, irrevocable letter of credit, or security of the type listed in Part II of Chapter 625, Florida Statutes. Such alternative forms of security shall be for the same purpose and shall be subject to the same conditions as those applicable to the bonds required by this section. The determination of the value and acceptability of such alternative forms of security shall be made exclusively by the City.

FORFEITURE

If within ten days after issuance of the Notice of Intent to Recommended Award, the successful Bidder refuses, or otherwise neglects, to execute and deliver the required Agreement, or fails to furnish the required Performance and Payment Bonds, or acceptable alternative forms of security as stipulated herein, or any required insurance certification, the Bidder shall be excluded from further consideration for award of the bid. No plea of mistake in the bid or misunderstanding of the conditions of forfeiture shall be available to the Bidder, or as a defense to any action based upon the neglect or refusal to execute the required Agreement, and/or to furnish the required bonds and/or applicable insurance certification.

LAWS AND REGULATIONS

All applicable Federal, State and local laws, ordinances, rules and regulations shall apply to this Agreement throughout, and they will be deemed to be included in the Agreement as though herein written. Florida law will govern all questions concerning implementation and execution of this contract and shall also be controlling in any cause of action brought pursuant to this contract.

CONTRACTURAL OBLIGATIONS

The successful Bidder may not sublet or subcontract any of the contractual obligations concerning this bid matter except as provided for in the written contract between the city and the Contractor. This statement does not prohibit subcontracting of the Work, but does prohibit subcontracting overall management obligations pertaining to the Work, or any substantial component thereof, and not more than eighty percent of the Work, as measured against the Bid Price, shall be subcontracted under any circumstances. This limitation of subcontracting shall not apply to any aspect of the

Work that involves the supply of equipment or materials alone. The Contractor shall retain ultimate liability for all contractual obligations.

BID WITHDRAWAL

Bids may not be changed after the bid closing time.

To withdraw a bid that includes a clerical error after bid opening, the bidder must give notice in writing to The City of Dade City of claim or right to withdraw a bid. Within two business days after the bid opening, the bidder requesting withdrawal must provide to the City all original work papers, documents, and other materials used in the preparation of the bid. A bidder may also withdraw a bid prior to the time set for the opening of bids by simply making a request in writing to The City of Dade City; no explanation is required. No bidder who is permitted to withdraw a bid shall, for compensation, supply any material or labor to or perform any subcontract or other work for the person to whom the contract is awarded or otherwise benefit from the contract. No partial withdrawals of a bid are permitted after the time and date set for the bid opening; only complete withdrawals are permitted. The decision to allow or disallow bid withdrawal remains solely with The City of Dade City.

BRAND NAMES

Any catalog, brand name, or manufacturer's reference used in the specifications is intended to be descriptive and not restrictive, and is used **only** to indicate type and quality desired. Any article, equipment, or material, which shall conform to the standards and excellence, so established, and is of equal merit, strength, durability, and appearance to perform the desired function, is deemed eligible for offer as a substitute. The qualifications of the offering shall be judged as to their conformance with these specifications. Any equipment offered other than herein specified shall be subject to a competitive demonstration and evaluation by the City. The determination as to whether any alternate product or service is or is not equal shall be made by the City, and such determination(s) shall be final and binding upon all bidders.

CERTIFICATION OF INDEPENDENT PRICE DETERMINATION

The bidder certifies that the prices submitted in response to the solicitation have been arrived at independently and without—for the purpose of restricting competition—any consultation, communication, or agreement with any other bidder or competitor relating to those prices, the intention to submit a bid, or the methods or factors used to calculate the prices bid.

CANCELLATION

The City of Dade City reserves the right to cancel a resulting contract, without cause, by giving thirty days prior written notice to the contractor of the intention to cancel, or with cause if at any time the contractor fails to fulfill or abide by any of the terms or conditions specified. Failure of the contractor to comply with any of the provisions of a resulting contract shall be considered a material breach of contract and shall be cause for immediate termination of the contract at the sole discretion of the City. In addition to all other legal remedies available to The City of Dade City, the City reserves the right to cancel and obtain from another source, any services which have not been provided within the required period of time or, if no such time is stated, within a reasonable period of time from the date of order or request, as determined by the City.

CHANGE IN SCOPE OF WORK

The City of Dade City may order changes in the work consisting of additions, deletions, or other revisions within the general scope of the contract. No claims may be made by the contractor that the scope of the project or of the contractor's services has been changed, requiring changes to the amount of compensation to the contractor or other adjustments to the contract, unless such changes or adjustments have been made by written amendment to the contract or purchase order signed by the City Public Works Director. If the contractor believes that any particular work is not within the scope of the project, is a material change, or will otherwise require more compensation to the contractor, the contractor must immediately notify the City in writing of this belief. If the City believes that the particular work is within the scope of the contract as written, the contractor will be ordered to and shall continue with the work as changed and at the cost stated for the work within the scope.

COLLUSION AMONG BIDDERS

Each bidder, by submitting a bid, certifies that it is not a party to any collusive action or any action that may be in violation of the Sherman Antitrust Act. Any or all bids shall be rejected if there is any reason for believing that collusion exists among the bidders. The City of Dade City may or may not, at its discretion, accept future bids for the same work from participants in such collusion. More than one bid from an individual, firm, partnership, cooperation, or association under the same or different names may be rejected. Reasonable grounds for believing that a bidder has interest in more than one bid for the work being bid may result in rejection of all bids in which the bidder is believed to have interest. Nothing in this clause shall preclude a firm acting as a subcontractor to be included as a subcontractor for two or more primary contractors submitting a bid for the work.

CONFLICT OF INTEREST

The contractor, by submission of its proposal, certifies that to the best of his/her knowledge or belief, no elected/appointed official or employee of The City of Dade City is financially interested, directly or indirectly, in the offer of goods or services specified in this invitation.

DEBARMENT

By submitting a bid, the bidder certifies that it is not currently debarred from submitting bids for contracts issued by any political subdivision or agency of the State of Florida and that it is not an agent of a person or entity that is currently debarred from submitting bids for contracts issued by any subdivision or agency of the State of Florida

ERRORS IN EXTENSIONS

If the unit price and the extension price are at variance, the unit price shall prevail.

ETHICS IN PUBLIC PROCUREMENT

The contract shall incorporate by reference, but shall not be limited to, the provisions of law contained in Chapter 112, Florida Statutes. A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity; may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work; may not

submit bids on leases or real property to a public entity; may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, Florida Statutes, for CATEGORY TWO for a period of thirty-six months from the date of being placed on the convicted vendor list. The bidder certifies that its bid was made without collusion or fraud; that it has not offered or received any kickbacks or inducements from any other bidder, supplier, manufacturer, or subcontractor in connection with this bid; and that it has not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services, or anything of value.

EXCEPTIONS

Bidders taking exception to any part or section of the solicitation shall indicate such exceptions on the bid form or appendix. Failure to indicate any exception will be interpreted as the bidder's intent to comply fully with the minimum requirements as written. Conditional or qualified bids, unless specifically allowed, shall be subject to rejection in whole or in part.

EXPENSES INCURRED IN PREPARING BID

The City of Dade City accepts no responsibility for any expense incurred by the bidder in the preparation and presentation of a bid. Such expenses shall be borne exclusively by the bidder.

FAILURE TO DELIVER

In the event of failure of the contractor to deliver the goods and services in accordance with the contract terms and conditions, The City of Dade City may procure the goods and services from their sources and hold the contractor responsible for any resulting additional costs. A failure to deliver will result in immediate termination of a resulting contract, and immediate qualification and debarment from submitting bids to the City for a maximum of three years. These remedies shall be in addition to any other remedies that the City may have available.

FAILURE TO ENFORCE

Failure by The City of Dade City at any time to enforce the provisions of the contract shall not be construed as a waiver of any such provisions. Such failure to enforce shall not affect the validity of the contract or any part thereof or the right of the City to enforce any provision at any time in accordance with its terms.

FAIR LABOR STANDARDS

By submission of a bid, the bidder certifies that the contractor(s) and/or subcontractor(s) providing product(s) or service(s) shall, in the execution or performance of such a contract, maintain fair labor standards as defined in applicable State and Federal regulations.

FORCE MAJEURE

The contractor shall not be held responsible for failure to perform the duties and responsibilities imposed by the contract due to legal strikes, fires, riots, rebellions, and acts of God beyond the control of the contractor, unless otherwise specified in the contract.

IDENTICAL BIDS

Identical bids or bids which otherwise appear suspicious will be reported to the City Attorney for investigation.

INDEMNIFICATION

In consideration of the sum of Fifteen Dollars, the receipt and sufficiency of which is acknowledged by the contractor to be included and paid for in the contract price, the contractor shall indemnify, defend, and hold harmless The City of Dade City and its agents and employees from and against all liabilities, claims, damages, losses, and expenses, including attorneys' fees, arising out of or resulting from the performance of the work, provided that any such liability, claim, damage, loss, or expense: 1) 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; and 2) is caused in whole or in part by any negligent act or omission of the contractor and subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, except for those caused by the negligent act or omission of the City.

In any and all claims against The City of Dade City or any of its agents or employees by any employee of the contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation under the previous paragraph shall not be limited in any way as to the amount or type of damages, compensation, or benefits payable by or for the contractor or any subcontractor under Workers' Compensation Acts, disability benefit acts, or other employee benefit acts.

It is further agreed that liability and exposure for indemnification will be limited to and governed by the provisions of Section 768.28(5), Florida Statutes.

INDEPENDENT CONTRACTOR

The contractor shall be legally considered an independent contractor and neither the contractor nor its employees shall, under any circumstances, be considered servants or agents of The City of Dade City; and the City shall be at no time legally responsible for any negligence or other wrongdoing by the contractor, its servants, or agents. The City shall not withhold from the contractor any Federal or State unemployment taxes, Federal or State income taxes, Social Security tax, or any other amounts for benefits to the contractor. Further, the City shall not provide to the contractor any insurance coverage or other benefits, including workers' compensation, normally provided by the City for its employees.

INFORMALITIES AND IRREGULARITIES

The City of Dade City has the right to waive minor defects or variations of a bid from the exact requirements of the specifications that do not affect the price, quality, quantity, delivery, or performance time of the services being procured. If insufficient information is submitted by a bidder with the bid for the City to properly evaluate the bid, the City has the right to require such additional information as it may deem necessary after the time set for receipt of bids, provided that the information requested does not change the price, quality, quantity, delivery, or performance time of the services being procured. The City Council reserves the right to reject any or all bids in

whole or in part; to award by any item, group(s) of items, total bid, or accept the bid that is most advantageous and in the best interest of the City.

LAW COMPLIANCE

Each party will comply with all applicable Federal, State and local laws, rules, regulations, and guidelines related to performance under this agreement. In particular, the contractor/vendor/named party verifies and affirms that it is in compliance with 8 U.S.C., Sec. 1324, prohibiting the employment either directly or by contract, subcontract, or exchange of unauthorized aliens in the United States. The City will consider the employment of unauthorized aliens by any contractor/vendor/named party, during the term of the agreement, a violation of the Immigration and Nationality Act. Such violation shall be cause for unilateral cancellation of this agreement by the City.

LIMITATION OF COST

The contractor agrees to perform the work specified and complete all obligations under the contract within the stated amounts.

NONCONFORMING TERMS AND CONDITIONS

A bid response that includes terms and conditions that do not conform to the terms and conditions in the bid document is subject to rejection as nonresponsive. The City of Dade City reserves the right to permit the bidder to withdraw nonconforming terms and conditions from its bid response prior to a determination by the City of non-responsiveness based on the submission of nonconforming terms and conditions.

NONDISCRIMINATION

By submission of bid, the bidder certifies that the contractor(s) and/or subcontractor(s) providing product(s) or service(s) shall not discriminate against any employee or applicant for employment, to be employed in the performance of such contract, with respect to his/her hire, tenure, terms, conditions, or privileges of employment, because of his/her race, color, religion, sex, disability, or national origin, as outlined in applicable State and Federal regulations.

ORAL STATEMENTS

No oral statement of any person shall modify or otherwise affect the terms, conditions, or specifications stated in this contract. All modifications to the contract or purchase order must be made in writing by the City of Dade City.

PATENTS AND ROYALTIES

The contractor covenants to save, defend, keep harmless, and indemnify The City of Dade City and all of its officers, departments, agencies, agents, and employees from and against all claims, loss, damage, injury, fines, penalties, and cost—including court costs and attorney's fees, charges, liability, and exposure, however caused—for or on account of any copyright or patented or unpatented invention, process, or article manufactured or used in the performance of the contract, including its use by the City. If the contractor uses any design, device, or materials covered by patent or copyright, it is mutually agreed and understood without exception that the contract price

includes all royalties or costs arising from the use of such design, device, or materials in any way in the work.

PAYMENT TERMS AND DISCOUNTS

Unless otherwise indicated in the bid documents, payment terms will be net forty-five days. Terms not consistent with this provision are not acceptable and may be cause for rejection. The City of Dade City will pay the contractor within forty-five days after the receipt of a correct invoice for the specified work.

PUBLIC INFORMATION

Upon public opening of all bids or proposals presented to The City of Dade City as a result of this solicitation, any and all information contained therein is considered public and may be reviewed by any persons interested in doing so.

PUBLIC RECORDS

Pursuant to Florida Statutes, Section 119.0701, the CONTRACTOR agrees to: (a) keep and maintain public records required by the CITY to perform the service contained herein; (b) upon request from the CITY's custodian of public records, provide the CITY with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided by Florida law; (c) ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the Agreement and any termination or completion of the Agreement if the CONTRACTOR does not otherwise transfer the records to the CITY as provided herein; (d) upon completion of the Agreement, transfer, at no cost, to the CITY all public records in possession of the CONTRACTOR or keep and maintain public records required by the CITY to perform the service. If the CONTRACTOR transfers all public records to the CITY upon completion of the Agreement, the CONTRACTOR shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the CONTRACTOR keeps and maintains public records upon completion of the Agreement, the CONTRACTOR shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the CITY, upon request from the CITY's custodian of public records, in a format that is compatible with the information technology systems of the CITY. **IF THE CONTRACTOR'S HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT 352-523-5050, AGUY@DADECITYFL.COM, 38020 MERIDIAN AVENUE, DADE CITY, FLORIDA 33525.**

PURCHASE ORDER REQUIREMENT

Purchases of The City of Dade City are authorized only if a signed purchase order is issued in advance of the transaction, showing that the ordering agency has sufficient funds available to pay for the service. Contractors providing services without a signed purchase order do so at their own risk. The City of Dade City will not be liable for payment for any services provided under the contract unless a valid purchase order has been issued to the contractor.

QUALIFICATIONS OF BIDDERS

The bidder may be required before the award of any contract to show to the complete satisfaction of The City of Dade City that it has the necessary facilities, ability, and financial resources to provide the service specified therein in a satisfactory manner. The bidder may also be required to give a past history and references in order to satisfy the City in regard to the bidder's qualifications. The City may make reasonable investigations deemed necessary and proper to determine the ability of the bidder to perform the work, and the bidder shall furnish to the City all information for this purpose that may be requested. The City reserves the right to reject any bid if the evidence submitted by, or investigation of, the bidder fails to satisfy the City that the bidder is properly qualified to carry out the obligations of the contract and to complete the work described therein. Evaluation of the bidder's qualifications shall include:

1. The ability, capacity, skill, and financial resources to perform the work or provide the service required.
2. The ability of the bidder to perform the work or provide the service promptly or within the time specified, without delay or interference.
3. The character, integrity, reputation, judgment, experience, and efficiency of the bidder.
4. The quality of performance of previous contracts or services.

RIGHT TO AUDIT

The contractor shall maintain such financial records and other records as they relate to the purchase of goods and/or services by the City of Dade City from the subject vendor. The contractor shall retain these records for a period of three years after final payment, or until they are audited by the City, whichever event occurs first. These records shall be made available during the term of the contract and the subsequent three-year period for examination, transcription, and audit by the City, its designees, or other authorized bodies.

TABULATIONS

Solicitation results (tabulations) will not be given over the telephone or via fax.

TAXES

All bids shall be submitted exclusive of direct Federal, State, and local taxes; however, if the bidder believes certain taxes are properly payable, he/she may list such taxes separately in each case directly below the respective item bid price. Prices quoted must be in units specified, and shall not include the cost of any such taxes, including those on any material, supplies, or equipment used or installed in the work. The City of Dade City does not pay Federal Excise and Sales Taxes on direct purchases of tangible personal property. See Exemption Number on face of the resulting purchase order. This exemption does not apply to purchases of tangible personal property made by contractors who use the tangible personal property in the performance of contracts for improvement of City-owned real property. Please refer to Chapter 192, Florida Statutes.

UNSATISFACTORY WORK

If, at any time during the contract term, the service performed or work done by the contractor is considered by the City of Dade City to create a condition that threatens the health, safety, or

welfare of the community, the contractor shall, on being notified by the City, immediately correct such deficient service or work. In the event the contractor fails, after notice, to correct the deficient service or work immediately, the City shall have the right to order the correction of the deficiency by separate contract or with its own resources at the expense of the contractor. Notwithstanding the above, the City reserves the right to cancel a resulting contract, without cause, by giving thirty days' prior written notice to the contractor of the intention to cancel.

END OF GENERAL PROVISIONS

SPECIAL PROVISIONS

In addition to the General Provisions of this solicitation, these Special Provisions, along with the specifications that follow, apply in like force to this solicitation and to any subsequent contract resulting therefrom.

CONTRACT TERM

The contract period will begin on the date of the Notice to Proceed following the date of City Commission approval and execution of the Contract Documents. The contract period shall continue for a period of 540 days, contingent on the appropriation of funds, unless canceled in writing by the City of Dade City. The project shall be substantially complete within 510 calendar days of the date of Notice to Proceed.

INSURANCE REQUIREMENTS

The insurance required must be written by an insurer authorized to do business in the State of Florida and also have an "A" policyholder's rating and a financial rating of at least Class VIII in accordance with the most current *Best's Key Rating Guide*. Prior to the time the contractor is entitled to commence any part of the project, work, or services under this contract, the contractor shall procure, pay for, and maintain at least the following insurance coverages and limits, or greater where required by Laws and Regulations. The said insurance shall be evidenced by delivery to the City of Dade City of 1) Certificates of Insurance executed by the insurers listing coverages and limits, expiration dates and terms of policies and all endorsements whether or not required by the City, and listing all carriers issuing the said policies; and 2) upon request, a certified copy of each policy, including all endorsements. The insurance requirements shall remain in effect throughout the term of this contract.

1. Workers' Compensation, and related coverages:

a. State:	Statutory
b. Applicable Federal (e.g., Longshoremen's):	Statutory
c. Employer's Liability:	{\$ 500,000}

2. Contractor's General Liability shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody, and control of the Contractor:

a. General Aggregate	{\$ 2,000,000}
b. Products – Completed Operations Aggregate	{\$ 1,000,000}
c. Personal and Advertising Injury	{\$ 1,000,000}
d. Each Occurrence (Bodily Injury and Property Damage)	{\$ 1,000,000}
e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.	
f. Excess or Umbrella Liability	
i. General Aggregate	{\$ 5,000,000}
ii. Each Occurrence	{\$ 5,000,000}

3. Automobile Liability:

- a. Bodily Injury:
 - i. Each Person {\$ 1,000,000}
 - ii. Each Accident {\$ 1,000,000}
- b. Property Damage:
 - i. Each Accident {\$ 1,000,000}
- c. Combined Single Limit of {\$ 1,000,000}

4. The Contractual Liability coverage shall provide coverage for not less than the following amounts:

- a. Bodily Injury:
 - i. Each Person {\$ 2,000,000}
 - ii. Each Accident {\$ 2,000,000}
- b. Property Damage:
 - i. Each Accident {\$ 2,000,000}
 - ii. Annual Aggregate {\$ 2,000,000}

Each insurance policy shall include the following conditions by endorsement to the policy:

1. Each policy shall require that thirty days prior to expiration, cancellation, nonrenewal, or any material change in coverages or limits, a notice thereof shall be given to The City of Dade City by certified mail to: The City of Dade City, 38020 Meridian Avenue, Dade City. The contractor shall also notify the City, in a like manner, within twenty-four hours after receipt, of any notices of expiration, cancellation, nonrenewal, or material change in coverage received by the said contractor from its insurer; and nothing contained herein shall absolve the contractor of this requirement to provide notice.
2. Companies issuing the insurance policy, or policies, shall have no recourse against The City of Dade City for payment of premiums or assessments for any deductibles that all are at the sole responsibility and risk of the contractor.
3. The term "City" or "City of Dade City" shall include all Authorities, Boards, Bureaus, Commissions, Divisions, Departments, and Offices of City and individual members, employees thereof in their official capacities, and/or while acting on behalf of the City of Dade City.
4. The City Commission of the City of Dade City shall be endorsed to the required policy or policies as an additional named insured.
5. The policy clause "Other Insurance" shall not apply to any insurance coverage currently held by the City to any such future coverage, or to the City's self-insured retentions of whatever nature.

REQUIREMENTS CONTRACT

During the period of the contract, the contractor shall provide all the services described in the contract. The contractor understands and agrees this is a requirements contract and the City of Dade City shall have no obligation to the contractor if no services are required. Any quantities that are included in the scope of work reflect the current expectations of the City for the period of the contract. The amount is only an estimate and the contractor understands and agrees the City is under no obligation to the contractor to buy any amount of the services as a result of having provided this estimate or of having any typical or measurable requirement in the past. The contractor further understands and agrees the City may require services in an amount less than or in excess of the estimated annual contract amount, and the quantity actually used, whether in excess of the estimate or less than the estimate, shall not give rise to any claim for compensation other than the total of the unit prices in the contract for the quantity actually used.

END OF SPECIAL PROVISIONS

BID FORM

TO THE City of Dade City
OWNER: 38020 Meridian Avenue
 Dade City, FL 33525

PROJECT: Tank Hill Water Facility Improvements
 Dade City, Florida
 City Project #1704WD

DATE: _____

LADIES and GENTLEMEN:

The undersigned Bidder, having carefully examined the premises and conditions affecting the work and having carefully examined the Instructions to Bidders, the Form of Agreement, and the Contract Documents for the project does hereby propose to furnish all labor, materials, equipment, and services for the proper execution and completion of the work called for and described by said documents for the following unit(s) of work:

No.	Description	Amount
1	Mobilization/Demobilization	\$.00
2	Administrative (permits, bonds, insurance, etc.)	\$.00
3	Site Work (site clearing, access road and gate, pond, fencing, stormwater, piping, etc.)	\$.00
4	Well Drilling Services (Total from Unit Price Table)	\$.00
5	Well outfitting (pump, well pad, piping, appurtenances, etc.)	\$.00
6	Booster pumps and hydropneumatic tank (pumps, piping, tank, etc.) including slab and cover	\$.00
7	NaOCl storage and feed system including containment slab and cover	\$.00
8	Elevated storage tank and foundation	\$.00
9	Electrical	\$.00
10	Instrumentation	\$.00
11	SCADA System Integration Allowance	\$ 40,000.00
12	Demolition (existing Tank Hill, College Heights, & Sally Road) facilities and off-site work (pressure reducing valves)	\$.00
TOTAL		\$.00

Quantities and Unit Bid Prices:

The bidder declares that he understands that the quantities shown below, if applicable, are estimates only, and are subject to either increase or decrease; and that should the quantities of any of the items of work be increased, the undersigned proposes to do the additional work at the unit prices set herein; and should the quantities be decreased, he also understands that payment will be made on actual quantities installed at the unit bid prices, and will make no claim for anticipated profits for any decrease in the quantities.

The bidder does hereby propose to furnish all labor, materials, equipment, and services for the proper execution and completion of the Well Drilling Services called for and described by the Contract Documents for the following unit prices:

No	Description	Quantity	Unit	Unit Price	Amount
4A	Mobilization/Demobilization	1	LS	\$	\$
4B	Permits, reports, administrative, etc.	1	LS	\$	\$
4C	Standard Penetration Test	80	LF	\$	\$
4D	Drill 24-inch borehole	20	LF	\$	\$
4E	Install & grout 20-inch surface casing	20	LF	\$	\$
4F	Drill well casing borehole	330	LF	\$	\$
4G	Install and grout 16-inch well casing	350	LF	\$	\$
4I	Drill 10-inch diameter open borehole	150	LF	\$	\$
4J	Cleaning, testing and video survey	500	LF	\$	\$
4K	4-hour specific capacity test	1	LS	\$	\$
4L	4-inch diameter well abandonment	400	LF	\$	\$
4M	6-inch diameter well abandonment	300	LF	\$	\$

TOTAL \$ _____ .00
(Enter Total Amount into bid table on first page)

Substantial Completion and Liquidated Damages:

The undersigned Bidder agrees to commence the work under his contract upon receipt of a Notice to Proceed from the Owner to achieve substantial completion of the work within **five hundred ten (510)** calendar days and **five hundred forty (540)** calendar days for final completion.

Failure of the Bidder to achieve substantial completion within the time specified will constitute violation of the terms of the contract and will result in an assessment of one hundred and fifty dollars per day liquidated damages by the Owner.

The undersigned Bidder agrees that:

The proposal shall remain in force and effect for a period of one hundred twenty calendar days from the time of this proposal and that the Bidder will not revoke, cancel, or withdraw this proposal within the said one hundred twenty calendar days.

In the event this proposal is accepted by the Owner, the parties will enter into a formal written agreement with the Owner in accordance with the accepted bid within twenty calendar days after said Contract Performance and Payment Bond with good and sufficient sureties satisfactory to the Owner, in the amount of one hundred percent of the accepted bid, the form and terms of which shall fully comply with Section 255.05, Florida Statutes.

Contractor shall begin work within seven days of issuance of the Notice to Proceed.

Acknowledgment is hereby made of receipt of the following Addenda issued during the bidding period:

Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____

IN WITNESS WHEREOF, the Bidder has hereunto set his signature and affixed his seal this

_____ day of _____. A.D. 20__.

I certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm, or person submitting a bid for the same materials, supplies, or equipment, and is in all respects fair and without collusion or fraud.

Firm Name: _____

(Type or Print)

Address: _____

City: _____ State: _____ Zip: _____

Phone: (____) _____

Names and title of officer or other individual executing proposal:

Signature: _____

Name: _____
(Type or Print)

Title: _____
(Type or Print)

SECTION 00220

CONTRACTOR PROJECT REFERENCE FORM

*(This form is required if the Prime Contractor submitting the Bid is not the Tank Manufacturer.
References located outside of Florida are not acceptable.)*

PROJECT 1

Project Name: _____

Project Value: _____ **Project Location:** _____

Project Start Date: _____ **Project End Date:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

PROJECT 2

Project Name: _____

Project Value: _____ **Project Location:** _____

Project Start Date: _____ **Project End Date:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

PROJECT 3

Project Name: _____

Project Value: _____ **Project Location:** _____

Project Start Date: _____ **Project End Date:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

CONTRACTOR PROJECT REFERENCE FORM [CONTINUED]

(References located outside of Florida are not acceptable.)

PROJECT 4

Project Name: _____

Project Value: _____ **Project Location:** _____

Project Start Date: _____ **Project End Date:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

PROJECT 5

Project Name: _____

Project Value: _____ **Project Location:** _____

Project Start Date: _____ **Project End Date:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

PROJECT 6

Project Name: _____

Project Value: _____ **Project Location:** _____

Project Start Date: _____ **Project End Date:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

SECTION 00225

TANK MANUFACTURER QUALIFICATION FORM

PROJECT 1

Project Name: _____

Project Location: _____ Tank Capacity: _____

Project Date/Year: _____ Consulting Engineer: _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

PROJECT 2

Project Name: _____

Project Location: _____ Tank Capacity: _____

Project Date/Year: _____ Consulting Engineer: _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

PROJECT 3

Project Name: _____

Project Location: _____ Tank Capacity: _____

Project Date/Year: _____ Consulting Engineer: _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

TANK MANUFACTURER QUALIFICATION FORM [CONTINUED]

PROJECT 4

Project Name: _____

Project Location: _____ **Tank Capacity:** _____

Project Date/Year: _____ **Consulting Engineer:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

PROJECT 5

Project Name: _____

Project Location: _____ **Tank Capacity:** _____

Project Date/Year: _____ **Consulting Engineer:** _____

Project Owner: _____

Contact Name: _____

Contact Phone #: _____

SAFE WORKING ENVIRONMENT (PAST 3 YEARS)

(Attach Statement from Insurance Carrier)

Experience Modification Rate (EMR): _____

Total Recordable Incident Rate (TRIR): _____

BID BOND

BIDDER (Name and Address):

OWNER (Name and Address): **City of Dade City
38020 Meridian Avenue
Dade City, FL 33525**

Penal sum: _____ (Words) _____ (Figures)

00230-1

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 Surety's liability.
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 by 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 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 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.

00240

Drug Free Work Place Certification

AFFIDAVIT ON DRUG FREE WORK PLACE. THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.

This sworn statement is submitted to the City of Dade City by _____ (print individual's name and title) for _____ (print name of entity submitting statement) whose business address is _____, and (if applicable) the Federal Employer Identification Number (FEIN) is _____ (if the entity has no FEIN, include the Social Security number of the individual signing this sworn statement _____).

I understand that no person or entity shall be awarded or receive a City of Dade City contract for public improvements, procurement of goods or services (including professional services), or a City lease, franchise, concession or management agreement, or shall receive a grant of City monies unless such person or entity has submitted a written certification to the City that it will provide a drug free work place by:

- (1) providing a written statement to each employee notifying such employee that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance as defined by §893.02(4), Florida Statutes, as the same may be amended from time to time, in the person's or entity's work place is prohibited specifying the actions that will be taken against employees for violation of such prohibition. Such written statement shall inform employees about:
 - (i) the dangers of drug abuse in the work place;
 - (ii) the person's or entity's policy of maintaining a drug free environment at all its workplaces, including but not limited to all locations where employees perform any task relating to any portion of such contract, business transaction or grant;
 - (iii) any available drug counseling, rehabilitation, and employee assistance programs; and
 - (iv) the penalties that may be imposed upon employees for drug abuse violations.
- (2) Requiring the employee to sign a copy of such written statement to acknowledge his or her receipt of same and advice as to the specifics of such policy. Such person or entity shall retain the statements signed by its employees. Such person or entity shall also post in a prominent place at all of its work places a written statement of its policy containing the foregoing elements (i) through (iv).
- (3) Notifying the employee in the statement required by subsection (1) that as a condition of employment the employee will:
 - (i) abide by the terms of the statement; and
 - (ii) notify the employer of any criminal drug statute conviction for a violation occurring in the work place no later than five (5) days after such a conviction.
- (4) Notifying the City within ten (10) days after receiving notice under subsection (3) from an employee or otherwise receiving actual notice of such conviction.
- (5) Imposing appropriate personnel action against such employee up to and including termination; or requiring such employee to satisfactorily participate in a drug abuse assistance or rehabilitation

program approved for such purposes by a federal, state, or local health, law enforcement, or other appropriate agency.

- (6) Making a good faith effort to continue to maintain a drug free work place through implementation of sections (1) through (5) stated above.

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CITY OF DADE CITY IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT ANY CONTRACT OR BUSINESS TRANSACTION SHALL PROVIDE FOR SUSPENSION OF PAYMENTS, OR TERMINATION, OR BOTH, IF THE CITY DETERMINES THAT:

- (1) Such person or entity has made false certification.
- (2) Such person or entity violates such certification by failing to carry out the requirements of sections (1), (2), (3), (4), (5), or (6) or subsection 3-101(7)(B); or
- (3) Such a number of employees of such person or entity have been convicted of violations occurring in the work place as to indicate that such person or entity has failed to make a good faith effort to provide a drug free work place as required by subsection 3-101(7)(B).

Signature

STATE OF FLORIDA
COUNTY OF _____

Sworn and subscribed before me this _____ day of _____, 2020, by

who appeared before me in person ____ (check this line if appropriate) or by online notarization ____ (check this line if appropriate) and is personally known to me ____ (check this line if appropriate) OR produced the following type of identification to prove identity _____.

[Print, type, or stamp commissioned name of Notary Public]

My commission expires: _____

00250 SWORN STATEMENT ON SCRUTINIZED COMPANIES CERTIFICATION

THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR
OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.

This sworn statement is submitted to the City of Dade City by _____
_____ (print individual's name and title) for
_____ (print name of entity submitting
statement) whose business address is _____,
and (if applicable) the Federal Employer Identification Number (FEIN) is _____
(if the entity has no FEIN, include the Social Security number of the individual signing this sworn statement
_____).

I understand that no person or entity shall be awarded or receive a contract for public improvements, procurement of goods or services (including professional services), or a lease, franchise, concession, or management agreement, or shall receive a grant of public monies unless such person or entity complies with Section 287.135, Florida Statutes.

Specifically, Section 287.135, Florida Statutes, states in pertinent part: "A company is ineligible to, and may not, bid on, submit a proposal for, or enter into or renew a contract with an agency or local governmental entity for goods or services of: (a) Any amount if, at the time of bidding on, submitting a proposal for, or entering into or renewing such contract, the company is on the Scrutinized Companies that Boycott Israel List, created pursuant to s. 215.4725, or is engaged in a boycott of Israel; or (b) One million dollars or more if, at the time of bidding on, submitting a proposal for, or entering into or renewing such contract, the company: 1. Is on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, created pursuant to s. 215.473; or 2. Is engaged in business operations in Cuba or Syria."

By signing this sworn statement, a bidder/proposer: (i) certifies the company is not in violation of Section 287.135, Florida Statutes, and shall not be in violation at the time the company enters into or renews any resulting contract; and (ii) agrees any such resulting contract shall be deemed to contain a provision that allows the City, at its option, to terminate such contract for cause if the company is found to have submitted a false certification, been placed on one or any of the foregoing Lists, been engaged in a boycott of Israel, or been engaged in business operations in Cuba or Syria.

Signature

STATE OF FLORIDA
COUNTY OF _____

Sworn and subscribed before me this _____ day of _____, 2020, by

who appeared before me in person _____ (check this line if appropriate) or by online notarization
_____ (check this line if appropriate) and is personally known to me _____ (check this line if
appropriate) OR produced the following type of identification to prove identity
_____.

[Print, type, or stamp commissioned name of Notary Public]

My commission expires: _____

00260

PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES CERTIFICATION

THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC
OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.

This sworn statement is submitted to the City of Dade City by _____
_____ (print individual's name and title) for
_____ (print name of entity submitting
statement) whose business address is _____,
and (if applicable) the Federal Employer Identification Number (FEIN) is _____ (if
the entity has no FEIN, include the Social Security number of the individual signing this sworn statement
_____).

I understand that no person or entity shall be awarded or receive a City of Dade City contract for public improvements, procurement of goods or services (including professional services), or a City lease, franchise, concession or management agreement, or shall receive a grant of City monies unless such person or entity has submitted a written certification to the City that it has not:

- (1) been convicted of bribery or attempting to bribe a public officer or employee of City, the State of Florida, or any other public entity, including, but not limited to the Government of the United States, any state, or any local government authority in the United States, in that officer's or employee's official capacity; or
- (2) been convicted of an agreement or collusion among bidders or prospective bidders in restraint of freedom of competition, by agreement to bid a fixed price, or otherwise; or
- (3) been convicted of a violation of an environmental law that, in the sole opinion of the City's project manager, reflects negatively upon the ability of the person or entity to conduct business in a responsible manner; or
- (4) made an admission of guilt of such conduct described in items (1), (2) or (3) above, which is a matter of record, but has not been prosecuted for such conduct, or has made an admission of guilt of such conduct, which is a matter of record, pursuant to formal prosecution. An admission of guilt shall be construed to include a plea of nolo contendere; or
- (5) where an officer, official, agent or employee of a business entity has been convicted of or has admitted guilt to any of the crimes set forth above on behalf of such and entity and pursuant to the direction or authorization of an official thereof (including the person committing the offense, if he is an official of the business entity), the business shall be chargeable with the conduct herein above set forth. A business entity shall be chargeable with the conduct of an affiliated entity, whether wholly owned, partially owned, or one which has common ownership or a common Board of Directors. For purposes of this Form, business entities are affiliated if, directly or indirectly, one business entity controls or has the power to control another business entity, or if an individual or group of individuals controls or has the power to control both entities. Indicia of control shall include, without limitation, interlocking management or ownership, identity of interests among family members, shared organization of a business entity following the ineligibility of a business entity, or using substantially the same management, ownership, or principles as the ineligible entity.

Any person or entity who claims that the provisions of this affidavit are inapplicable to him or her or the company or business entity because a conviction or judgment has been reversed by a court of competent jurisdiction, shall prove the same with documentation satisfactory to the City's project manager. Upon presentation of such satisfactory proof, the person or entity shall be allowed to contract with the City.

I UNDERSTAND THAT ANY CONTRACT OR BUSINESS TRANSACTION SHALL PROVIDE FOR SUSPENSION OF PAYMENTS OR TERMINATION OF CONTRACT, OR BOTH, IF THE CONTRACTING OFFICER OR THE CITY DETERMINES THAT **SUCH PERSON OR ENTITY HAS MADE FALSE CERTIFICATION.**

Signature

STATE OF FLORIDA

COUNTY OF _____

Sworn and subscribed before me this _____ day of _____, 2020, by

who appeared before me in person ____ (check this line if appropriate) or by online notarization ____ (check this line if appropriate) and is personally known to me ____ (check this line if appropriate) OR produced the following type of identification to prove identity
_____.

[Print, type, or stamp commissioned name of Notary Public]

My commission expires: _____

00310 Notice of Award

Date _____

Project: Tank Hill Water Facility Improvements	Owner: City of Dade City	Owner's Contract No.:
Contract: (1) installation of a new ~500-ft deep water supply well; (2) installation of a new deep well vertical turbine pump with associated piping, appurtenances and well pad; (3) new elevated storage tank; (4) two new booster pumps and hydropneumatic tank; (5) new sodium hypochlorite feed system; (6) miscellaneous site work; and (7) electrical and instrumentation modifications. See agreement for detailed contract documents and scope of work.		Engineer's Project No.: DAD003
Bidder:		
Bidder's Address:		

You are notified that your Bid dated _____ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for the above project.

The Contract Price of your Contract is \$ _____

Four copies of Contract Documents accompany this Notice of Award.

You must comply with the following conditions precedent within 10 calendar days of the date you receive this Notice of Award.

1. Deliver to the Owner **four** fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Florida Performance Bond and the Florida Payment Bond.

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

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Contract Documents.

CITY OF DADE CITY

Owner

By:

Authorized Signature

City Manager

Title

Copy to Engineer

00320 Notice to Proceed

Date _____

Project: Tank Hill Water Facility Improvements	Owner: City of Dade City	Owner's Contract No.:
Contract:		Engineer's Project No.: DAD003
Contractor:		
Contractor's Address:		

You are notified that the Contract Times under the above contract will commence to run on _____. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with the Agreement, readiness for final payment is 540 days.

Before you may start any Work at the Site, the General Conditions provide that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must secure the requisite construction permits and satisfy all state and federal workforce notification requirements.

_____	City of Dade City, Florida
Contractor	Owner
Received by: _____	Given by: _____
	Authorized Signature
	City Manager
_____	_____
Title	Title
_____	_____
Date	Date

Copy to Engineer

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00400 AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT
(STIPULATED PRICE)

THIS AGREEMENT is by and between the City of Dade City (“Owner”), a municipal corporation of the State of Florida, and _____ (“Contractor”), a Florida corporation.

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

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

(1) installation of a new water supply well approximately 500 feet in depth, (2) installation of a new deep well vertical turbine pump with associated piping, appurtenances and well pad; (3) new elevated storage tank; (4) two new booster pumps and hydropneumatic tank; (5) new sodium hypochlorite feed system; (6) miscellaneous site work; and (7) electrical and instrumentation modifications

ARTICLE 2 – THE PROJECT

- 2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

ARTICLE 3 – ENGINEER

- 3.01 The Project has been designed by Infrastructure Solution Services, LLC, which is to act as the Engineer for the project. The City Engineer shall assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

- 4.01 Time of the Essence

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

4.02 Dates for Substantial Completion and Final Payment

- A. The Work will be substantially completed on or before five hundred ten calendar days after the date when the Contract Times commence to run as provided in the General Conditions, and completed and ready for final payment in accordance with the General Conditions.

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 loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the General Conditions. 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), Contractor shall pay Owner \$150 for each day that expires after the time specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner \$150 for each day that expires after the time specified in Paragraph 4.02 above for completion and readiness for final payment 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 and General Conditions, an amount in current funds equal to the sum of the amounts determined below:

No.	Description	Amount
1	Mobilization/Demobilization	\$.00
2	Administrative (permits, bonds, insurance, etc.)	\$.00
3	Site Work (clearing, access road, pond, fencing, stormwater, piping, etc.)	\$.00
4	Well drilling services (new well construction, well abandonment, testing, etc.)	\$.00
5	Well outfitting (pump, well pad, piping, appurtenances, etc.)	\$.00
6	Booster pumps & hydro. tank (pumps, piping, tank, etc.) incl. slab and cover	\$.00
7	NaOCl storage and feed system including containment slab and cover	\$.00
8	Elevated storage tank and foundation	\$.00
9	Electrical	\$.00
10	Instrumentation	\$.00
11	SCADA System Integration Allowance	\$.00
12	Demolition (Tank Hill, College Heights, & Sally Road) & off-site work (PRV)	\$.00

TOTAL \$.00

In the event changes in the Well Drilling Services (Item 4) are required, a change order shall be issued based on the unit prices listed below:

No	Description	Quantity	Unit	Unit Price	Amount
4A	Mobilization/Demobilization	1	LS	\$	\$
4B	Permits, reports, administrative, etc.	1	LS	\$	\$
4C	Standard Penetration Test	80	LF	\$	\$
4D	Drill 24-inch borehole	20	LF	\$	\$
4E	Install & grout 20-inch surface casing	20	LF	\$	\$
4F	Drill well casing borehole	330	LF	\$	\$
4G	Install and grout 16-inch well casing	350	LF	\$	\$
4I	Drill 10-inch diameter open borehole	150	LF	\$	\$
4J	Cleaning, testing and video survey	500	LF	\$	\$
4K	4-hour specific capacity test	1	LS	\$	\$
4L	4-inch diameter well abandonment	400	LF	\$	\$
4M	6-inch diameter well abandonment	300	LF	\$	\$

TOTAL \$ _____ .00
(Total Amount shall equal Amount for Item 4 on previous table)

The Bid prices for Unit Price Work set forth as of the Effective Date of the Agreement are based on estimated quantities. As provided in the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer as provided in the General Conditions for all Work, at the prices stated in Contractor's Bid, attached hereto and incorporated herein.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

- A. Contractor shall submit Applications for Payment in accordance with the General Conditions attached hereto and made a part hereof. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 Final Payment

- A. Upon final completion and acceptance of the Work in accordance with the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer upon submittal by Contractor of appropriate information and documentation.

ARTICLE 7 – INTEREST

- 7.01 All moneys not paid when due as provided in the General Conditions shall bear interest at the rate of five percent (5%) per annum.

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

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

- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bid Documents.
- B. Contractor has visited the Site 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 federal, state, and local laws and regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has considered the information known to Contractor; 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, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) Contractor’s safety precautions and programs.
- E. Based on the information and observations referred to in Paragraph 7.01.D above, Contractor does not consider that 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 Documents.

- F. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- G. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- H. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 Contents

- A. The Contract Documents consist of the following:
 - 1. Invitation to Bid
 - 2. Construction Documents
 - 3. Notice of Award
 - 4. This Agreement
 - 5. Performance Bond
 - 6. Payment Bond
 - 7. Power of Attorney
 - 8. Contract Conditions
 - 9. Notice to Proceed
- B. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 Terms

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

10.02 Assignment of Contract

- A. 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, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that

the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 Successors and Assigns

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

10.04 Severability

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

10.05 Contractor's Certifications

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

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. Counterparts have been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or have been identified by Owner and Contractor or on their behalf.

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

OWNER:

City of Dade City

By: _____

Title: _____

Attest: _____

Title: _____

Address for giving notices:

38020 Meridian Avenue

Dade City, Florida 33525

CONTRACTOR

By: _____

Title: _____

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

Attest: _____

Title: _____

Address for giving notices:

License No.: _____

(Where applicable)

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00510 PERFORMANCE 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):

City of Dade City

(Mailing Address)

38020 Meridian Avenue

PO Box 1355

Dade City, FL 33525

Dade City, FL 33526-1355

CONTRACT

Date:

Amount: \$

Description (Name and Location):

BOND

Bond Number:

Date (Not earlier than Contract Date):

Amount:

Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the following pages hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)

Name and Title:

(Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____

Signature and Title

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)
Name and Title:

Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.
2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.
3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:
 - 3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
 - 3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and
 - 3.3. Owner has agreed to pay the Balance of the Contract Price to:
 1. Surety in accordance with the terms of the Contract;
 2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.
4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:
 - 4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
 - 4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or
 - 4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:
 1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefore to Owner; or
 2. Deny liability in whole or in part and notify Owner citing reasons therefore.
5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:
 - 6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;
 - 6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and
 - 6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.
7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the 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 Owner or its heirs, executors, administrators, or successors.
8. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.
9. 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 Contractor Default or within two years after Contractor ceased working or within two years after 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 period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.
11. 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.
12. Definitions.
 - 12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.
 - 12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 12.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
 - 12.4. 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 comply with the other terms thereof.

00520 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):

City of Dade City
38020 Meridian Avenue
Dade City, FL 33525

(Mailing Address)

PO Box 1355
Dade City, FL 33526-1355

CONTRACT

Date:

Amount: \$

Description (Name and Location):

BOND

Bond Number:

Date (Not earlier than Contract Date):

Amount:

Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the following pages hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)

Name and Title:

(Seal)

Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL

SURETY

Company:

Signature: _____ (Seal)

Name and Title:

_____ (Seal)

Surety's Name and Corporate Seal

By: _____

Signature and Title

(Attach Power of Attorney)

Attest: _____

Signature and Title:

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 addresses 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 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. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:
 - 6.1. Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
 - 6.2. Pay or arrange for payment of any undisputed amounts.
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 Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

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 comply with the other terms thereof.

FOR INFORMATION ONLY – Name, Address and Telephone

Surety Agency or Broker:

Owner's Representative (engineer or other party):

00600 LIMITED POWER OF ATTORNEY

_____ hereby grants the City Clerk of the City of Dade City, Florida Power of Attorney to insert the date of execution on the contract, surety bonds to the contract and agreement entitled, Tank Hill Water Facility Improvements.

In Witness Whereof, _____ have hereunto set _____ hand and seal this _____ day of _____, 20__.

Principal

Surety

Witnesses:

CORPORATE ACKNOWLEDGEMENT

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, _____ by _____ (name of officer or agent, title of officer or agent), of _____ (name of corporation acknowledging), a _____ (state or place of incorporation) corporation, on behalf of the corporation. He/She is (personally known to me) (or has produced identification) _____ (type of identification) (as identification) and (did/did not) take an oath.

Signature of Person Taking
Acknowledgment

Name of Acknowledger Typed,
Printed or Stamped

ACKNOWLEDGMENT IF PRINCIPAL IS AN INDIVIDUAL

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, by _____ (name of person acknowledged), who is personally known to me or has produced _____ (type of identification) as identification and who did (did not) take an oath.

Signature of Person Taking Acknowledgment

Name of Acknowledger Typed,
Printed or Stamped

ACKNOWLEDGMENT IF PARTNERSHIP

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, by _____ (name of acknowledging partner or agent) of _____, partner (or agent) on behalf of _____ (name of partnership), a partnership. He/She is (personally known to me) (or has produced identification) _____ (type of identification) (as identification) and (did/did not) take an oath.

Signature of Person Taking
Acknowledgment

Name of Acknowledger Typed,
Printed or Stamped

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision 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 consider 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.
- D. It is further agreed that liability and exposure for indemnification will be limited to and governed by the provisions of Section 768.28(5), Florida Statutes.

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.

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Section 800

SUPPLEMENTARY CONDITIONS (CONSTRUCTION)

Florida Department of Environmental Protection
State Revolving Fund Program
Supplementary Conditions
for

Formally Advertised
Construction Procurement

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ENVIRONMENTAL PROTECTION
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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

The intent of the Florida Department of Environmental Protection (FDEP) Supplementary Conditions is to complement and supplement other provisions of the Bidding Documents. However, if there is any conflict between the FDEP Supplementary Conditions and other provisions of the Bidding Documents, the FDEP Supplementary Conditions shall take precedence over the other provisions except when the other provisions are similar to, but more stringent than, the FDEP Supplementary Conditions. When other provisions of the Bidding Documents are similar to, but more stringent than, the FDEP Supplementary Conditions, the more stringent provisions shall apply.

ARTICLE 1 - DEFINITIONS

Wherever used in these Supplementary Conditions (except in the appendices to these Supplementary Conditions), the following terms have the meanings indicated, which are applicable to both the singular and plural thereof.

- 1.1 Addendum - A written or graphic instrument that is issued prior to the opening of bids and that clarifies, corrects, or changes the Bidding Documents.
- 1.2 Agreement or Contract - The written agreement between the Owner and the Contractor covering the Work to be performed and furnished; these Supplementary Conditions and other Contract Documents are attached to the Agreement/Contract and made a part thereof as provided therein.
- 1.3 Bid - The offer or proposal of a bidder submitted on the prescribed form and setting forth the price(s) for the Work to be performed and furnished.
- 1.4 Bidder - Any person, firm, or corporation that submits a bid directly to the Owner.
- 1.5 Bidding Documents - The Advertisement for Bids or the Invitation to Bid, the Instructions to Bidders or the Information for Bidders, the Bid Form, the proposed Contract Documents, and all addenda.
- 1.6 Bond - An instrument of security.
- 1.7 Change Order - A document that is recommended by the Engineer and signed by the Contractor and the Owner; that authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Time; and that is issued on or after the Effective Date of the Agreement/Contract.
- 1.8 Contract Documents - The Agreement/Contract; the Contractor's Bid when attached as an exhibit to the Agreement/Contract; the Performance and Payment Bond(s); the General Conditions; the Supplementary Conditions (including these Supplementary Conditions); the Specifications (written technical descriptions of material, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto); the Drawings (drawings that show the character and scope of the Work to be performed and furnished); all addenda that pertain to the Contract Documents; and all change orders.
- 1.9 Contract Time - The number of days or the date stated in the Contract Documents for completion of the Work.
- 1.10 Contractor - The person, firm, or corporation with whom or which the Owner enters into the Agreement/Contract.
- 1.11 Effective Date of the Agreement/Contract - The date indicated in the Agreement/Contract on which the Agreement/Contract becomes effective, or if no such date is indicated in the Agreement/Contract, the date on which the Agreement/Contract is signed and delivered by the last of the two parties to sign and deliver the Agreement/Contract.
- 1.12 Engineer - The person, firm, or corporation named as such in the Contract Documents.
- 1.13 Minority Business Enterprise (MBE) - A historically Black college or university or a business that is (a) certified as socially and economically disadvantaged by the Small Business Administration, (b) certified as an MBE by a state or federal agency, or (c) an independent business concern which is at least 51-percent owned and controlled by minority group members. (A minority group member is an individual who is a citizen of the United States and one of the following: [i] Black American; [ii] Hispanic American [with origins from Puerto Rico, Mexico, Cuba, or South or Central America]; [iii] Native American [American Indian, Eskimo, Aleut, or native Hawaiian]; or [iv] Asian-Pacific American

[with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, the U.S. Trust Territories of the Pacific, Northern Marianas, Laos, Cambodia, Taiwan, or the Indian Subcontinent].)

1.14 Notice to Proceed -The written notice given by the Owner to the Contractor fixing the date on which the Contract Time will commence to run and on which the Contractor shall start to perform its obligations under the Contract Documents.

1.15 Owner - The local government (municipality, county, district, or authority; or any agency thereof; or a combination of two or more of the foregoing acting jointly) with which the Florida Department of Environmental Protection (FDEP) may execute, or has executed, a State Revolving Fund loan agreement and for which the Work is to be provided.

1.16 Project - The total construction or facilities described in a State Revolving Fund loan agreement between the FDEP and the Owner, of which the Work to be provided under the Contract Documents may be the whole or a part.

1.17 Sponsor – The recipient of the State Revolving Fund loan agreement that provides funds for the project.

1.18 Subcontract - A direct contract between a subcontractor and the Contractor, or any other subcontractor at any tier, for the furnishing of goods (material and equipment) or the performance of services (including construction) necessary to complete the Work.

1.19 Subcontractor - A person, firm, or corporation having a direct contract with the Contractor, or any other subcontractor at any tier, for the furnishing of goods (material and equipment) or the performance of services (including construction) necessary to complete the Work.

1.20 Successful Bidder - The lowest responsive, responsible bidder to whom or which the Owner intends to award the Agreement/Contract.

1.21 Women's Business Enterprise (WBE) - A business that is (a) certified as a WBE by a state or federal agency or (b) an independent business concern which is at least 51-percent owned and controlled/operated by women. (Determination of whether a business is at least 51-percent owned by women shall be made without regard to community property laws [e.g., an otherwise qualified WBE that is 51-percent owned by a married woman in a community property state will not be disqualified because the married woman's husband has a 50-percent interest in the married woman's share of the business; similarly, a business that is 51-percent owned by a married man and 49-percent owned by women will not become a qualified WBE by virtue of the married man's wife having a 50-percent interest in the married man's share of the business].)

1.22 Work - The entire completed construction or the various separately identifiable parts thereof required to be performed and furnished under the Contract Documents; Work is the result of performing services, furnishing labor, furnishing material and equipment, and incorporating material and equipment into the construction as required by the Contract Documents.

ARTICLE 2 - PRIVACY OF AGREEMENT/CONTRACT

2.1. The Owner expects to finance this Agreement/Contract with assistance from the FDEP, which administers a State Revolving Fund loan program supported in part with funds directly made available by grants from the United States Environmental Protection Agency (USEPA). Neither the State of Florida nor the United States (nor any of their departments, agencies, or employees) will be a party to this Agreement/Contract or any lower-tier subcontract.

ARTICLE 3 - PROCUREMENT REQUIREMENTS

3.1. This Agreement/Contract and the Owner's solicitation and award of this Agreement/Contract are subject to requirements contained in Chapter 62-503 (Revolving Loan Program) and/or Chapter 62-552, Florida Administrative Code as applicable.

ARTICLE 4 - RESOLUTION OF PROTESTS AND CLAIMS/DISPUTES

Resolution of Protests Concerning the Owner's Solicitation and/or Award of this Agreement/Contract:

4.1. Protests concerning the Owner's solicitation and/or award of this Agreement/Contract must be filed in writing with the Owner to be considered.

4.2. All timely written protests concerning the Owner's solicitation and/or award of this Agreement/Contract are to be resolved in accordance with the Owner's dispute resolution process. A copy of the ordinance(s), resolution(s), or written policy (policies) that set forth the Owner's dispute resolution process is included elsewhere in the Bidding Documents or is to be made available by the Owner upon request.

4.3. Neither the (FDEP) nor the USEPA will become a party to, or have any role in resolving, protests concerning the Owner's solicitation and/or award of this Agreement/Contract. Protest decisions made by the Owner cannot be appealed to the FDEP or the USEPA.

Resolution of Claims and Disputes Between the Owner and the Contractor:

4.4. Unless otherwise provided in the Contract Documents, all claims and disputes between the Owner and the Contractor arising out of, or relating to, the Contract Documents or the breach thereof are to be decided by arbitration (if the Owner and the Contractor mutually agree) or in a court of competent jurisdiction within the State of Florida.

4.5. Neither the FDEP nor the USEPA will become a party to, or have any role in resolving, claims and disputes between the Owner and the Contractor.

ARTICLE 5 - CHANGES TO THE BIDDING AND CONTRACT DOCUMENTS

5.1. All changes to the Bidding Documents made subsequent to the FDEP's acceptance of the Bidding Documents and prior to the opening of bids are to be documented via addendum (addenda) to the Bidding Documents; all changes to the Contract Documents made after the opening of bids are to be documented by change order(s) to the Contract Documents. The Owner shall submit all addenda and change orders to the FDEP.

ARTICLE 6 - BONDS AND INSURANCE

Bid Guarantees:

6.1. Each bidder's bid is to be accompanied by a bid guarantee made payable to the Owner in an amount at least equal to five percent of the bidder's maximum bid price and in the form of a certified check or bid bond.

Performance and Payment Bond(s):

6.2. The Contractor shall furnish a combined performance and payment bond in an amount at least equal to 100 percent of the Contract Price (or, if required elsewhere in the Contract Documents, the Contractor shall furnish separate performance and payment bonds, each in an amount at least equal to 100 percent of the Contract Price) as security for the faithful performance and payment of all the Contractor's obligations under the Contract Documents. This(these) bond(s) are to be delivered to the Owner by the Contractor along with the executed Agreement/Contract. The Owner shall forward a copy of this (these) bond(s) to the FDEP.

Insurance:

6.3. The Owner and/or the Contractor (as required elsewhere in the Contract Documents) shall purchase and maintain, during the period of construction, such liability insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims that may arise out of, or result from, the Contractor's performance and furnishing of the Work (whether the Work is to be performed or furnished by the Contractor or any subcontractor at the Work site) and the Contractor's other obligations under the Contract Documents. This insurance is to include workers' compensation insurance, comprehensive general liability insurance, comprehensive automobile liability insurance, and contractual liability insurance applicable to the Contractor's indemnification obligations and is to be written for not less than the limits of liability and coverages determined by the Owner or required by law, whichever is greater.

6.4. The Owner and/or the Contractor (as required elsewhere in the Contract Documents) shall purchase and maintain, during the period of construction, property insurance upon the Work at the Work site in an amount equal to the full replacement cost of the Work or the full insurable value of the Work. This insurance is to include the interests of the Owner, the Contractor, and all subcontractors at the Work site (all of whom are to be listed as insured or additional insured parties); is to insure against the perils of fire and extended coverage; and is to include "all-risk" insurance for physical loss or damage due to theft, vandalism and malicious mischief, collapse, water damage, and/or all other risks against which coverage is obtainable.

6.5. Before any Work at the Work site is started, the Contractor shall deliver to the Owner certificates of insurance that the Contractor is required to purchase and maintain in accordance with Paragraphs 6.3 and 6.4 of this Article and other provisions of the Contract Documents, and the Owner shall deliver to the Contractor certificates of insurance that the Owner is required to purchase and maintain in accordance with Paragraphs 6.3 and 6.4 of this Article and other provisions of the Contract Documents.

ARTICLE 7 - AWARD OF AGREEMENT/CONTRACT

7.1. If this Agreement/Contract is awarded, it is to be awarded to the lowest responsive, responsible bidder. A fixed price (lump sum or unit price or both) agreement/contract is to be used. A clear explanation of the method of evaluating bids and the basis for awarding this Agreement/Contract are included elsewhere in the Bidding Documents. All bids may be rejected when in the best interest of the Owner. After the contract has been awarded, the Owner shall give the Contractor a notice to proceed fixing the date on which the Contract Time will commence to run. The Owner shall forward a copy of this notice to proceed to the FDEP.

ARTICLE 8 - ITEMIZED CONSTRUCTION COST BREAKDOWN; CONSTRUCTION AND PAYMENT SCHEDULES

8.1. The Contractor shall submit to the Owner, within ten calendar days after the Effective Date of this Agreement/Contract, an itemized construction cost breakdown and construction and payment schedules.

8.1.1. The itemized construction cost breakdown, or schedule of values, is to include quantities and prices of items aggregating the Contract Price and is to subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices are to include an appropriate amount of overhead and profit applicable to each item of Work.

8.1.2. The construction, or progress, schedule is to indicate the Contractor's estimated starting and completion dates for the various stages of the Work and is to show both the projected cost of Work completed and the projected percentage of Work completed versus Contract Time.

8.1.3. The payment schedule is to show the Contractor's projected payments cumulatively by month.

ARTICLE 9 – FDEP/USEPA ACCESS TO RECORDS AND PROJECT SITE

9.1. Authorized representatives of the Owner, the FDEP, and the USEPA shall have access to, for the purpose of inspection, the Work site(s), any books, documents, papers, and records of the Contractor that are pertinent to this Agreement/Contract at any reasonable time. The Contractor shall retain all books, documents, papers, and records pertinent to this Agreement/Contract for a period of five years after receiving and accepting final payment under this Agreement/Contract.

NOTE: ARTICLE 10 ONLY APPLIES TO FEDERAL CAP GRANT PROJECTS

ARTICLE 10 - DISADVANTAGED BUSINESS ENTERPRISES

10.1 A goal of five percent of the Contract Price is established for Minority Business Enterprise (MBE) participation in the Work, and a goal of five percent of the Contract Price is established for Women's Business Enterprise (WBE) participation in the Work. If bidders or prospective contractors (including the Contractor) intend to let any lower-tier goods

or services (including construction) subcontracts for any portion of the Work, they shall physically include these percentage goals for MBE and WBE participation in all solicitations for subcontracts and shall take good faith efforts to assure that MBEs and WBEs are utilized, when possible, as sources of goods and services. Good faith efforts are to include the following:

10.1.1. Require Disadvantaged Business Enterprises (DBEs) are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

10.1.2. 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 solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

10.1.3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

10.1.4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

10.1.5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

10.1.6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs 10.1.1 through 10.1.5 of this section.

10.2. Within ten calendar days after being notified of being the apparent Successful Bidder, the apparent Successful Bidder shall submit to the Owner documentation of the affirmative steps it has taken to utilize Minority and Women's Business Enterprises (MBEs and WBEs) in the Work and documentation of its intended use of MBEs and WBEs in the Work. The Owner shall keep this documentation on file and shall forward to the FDEP a copy of the apparent Successful Bidder's documentation concerning its intended use of MBEs and WBEs in the Work.

ARTICLE 11 - DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)

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

11.1. The bidder certifies, by submission of this proposal, that neither the bidder nor its principals, nor the bidder's subcontractors nor their principals, are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

11.2. Where the bidder is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

11.3. The bidder also certifies that it and its principals and the bidder's subcontractors and their principals:

11.3.1. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or contract under a public transaction; violation of federal or state anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

11.3.2. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses enumerated in paragraph 11.3.1 of this certification; and

11.3.3. Have not within a three-year period preceding this proposal had one or more public transactions (federal, state or local) terminated for cause or default. Where the bidder is unable to certify to any of the above, such owner shall attach an explanation to this proposal.

11.3.4. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the federal government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

11.3.5. The bidder shall incorporate the foregoing requirements 11.1 through 11.3 in all subcontracts.

ARTICLE 12 - EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

12.1. Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246). (Applicable to contracts/subcontracts exceeding \$10,000)

12.1.1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

12.1.2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in Florida, are as follows:

Goal for female participation: 6.9 percent statewide

Goal for minority participation: (See Appendix B at FDEP-20 for goals for each county)

These goals are applicable to all the Contractor's construction work (whether or not it is federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

12.1.3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

12.1.4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is the State of Florida.

12.1.5. Contractors shall incorporate the foregoing requirements in all subcontracts.

12.2. Equal Opportunity Clause (Applicable to contracts/subcontracts exceeding \$10,000)

During the performance of this contract, the contractor agrees as follows:

12.2.1. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants for employment 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.

12.2.2. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause. The notice can be obtained online at http://www.eeoc.gov/employers/upload/eeoc_self_print_poster.pdf. The Contractor shall state that all qualified applicants be considered without regard to race, color, religion, sex or national origin.

12.2.3. 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 considerations for employment without regard to race, color, religion, sex, or national origin.

12.2.4. 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 advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

12.2.5. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

12.2.6. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

12.2.7. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

12.2.8. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs 12.2.1 through 12.2.8 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 11246 of September 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 the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

12.3. The Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

12.3.1. As used in these specifications:

- a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
- b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
- c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
- d. "Minority" includes:
 - (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

12.3.2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

12.3.3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

12.3.4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction Contractors performing construction work in geographical areas where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

12.3.5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

12.3.6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

12.3.7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

- a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
- b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

- c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.
- d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 12.3.7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
- i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
- k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
- l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
- m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

- n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
- o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
- p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

12.3.8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (12.3.7a through 12.3.7p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

12.3.9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

12.3.10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

12.3.11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12.3.12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

12.3.13. The Contractor, in fulfilling its obligation under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

12.3.14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

12.3.15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

12.4. Pursuant to 41 CFR 60-1.7, if the price of this bid exceeds \$10,000, the bidder, by signing and submitting this proposal, certifies the following:

- 12.4.1. Affirmative action programs pursuant to 41 CFR 60-2 have been developed and are on file;
- 12.4.2. Documentation of a previous contract or subcontract subject to the equal opportunity clause is available;
- 12.4.3. All reports due under the applicable filing requirements have been filed with the Joint Reporting Committee, the Deputy Assistant Secretary or the Equal Employment Opportunity Commission; and
- 12.4.4. Each prospective construction subcontractor that may be awarded a lower-tier construction subcontract with a price exceeding \$10,000 shall meet the above requirements 12.4.1 through 12.4.3.

12.5. Pursuant to 41 CFR 60-1.8, if the price of this bid exceeds \$10,000, the bidder, by signing and submitting this proposal, certifies the following:

- 12.5.1. That he/she does not maintain or provide for his/her employees any segregated facility at any of his/her establishments;
- 12.5.2. That he/she does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained;
- 12.5.3. That he/she will not maintain or provide for employees any segregated facilities at any of his/her establishments;
- 12.5.4. That he/she will not permit employees to perform their services at any location under his/her control where segregated facilities are maintained;
- 12.5.5. That a breach of this certification is violation of the Equal Opportunity Clause of this contract; and
- 12.5.6. That he/she 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 certifications in his/her files.

As used in this certification, the term “segregated facilities” means any waiting rooms, work eating areas, time clocks, locker rooms, and other storage or dressing areas, transportation and housing facilities provided for employees which are in fact segregated on the basis of race, color, religion, or otherwise.

12.6. If the price of this Agreement/Contract exceeds \$10,000, the Owner shall give written notice to the Director of the Office of Federal Contract Compliance Programs within ten working days of award of this Agreement/Contract. The notice is to include the name, address, and telephone number of the Contractor; the employer identification number of the Contractor; the dollar amount of this Agreement/Contract; the estimated starting and completion dates of this Agreement/Contract; the number of this Agreement/Contract; and the geographical area in which the Work is to be performed.

12.7. If the price of this Agreement/Contract equals or exceeds \$50,000 and if the Contractor has 50 or more employees, the Contractor shall electronically file Standard Form 100 (EEO-1) online at <https://egov.eeoc.gov/eo1/eo1.jsp> within 30 calendar days after the award of this Agreement/Contract, unless the Contractor has submitted such a report within 12 months preceding the date of award of this Agreement/Contract. In addition, the Contractor shall ensure that each construction subcontractor having 50 or more employees and a lower-tier construction subcontract with a price equaling or exceeding \$50,000 also electronically files this form within 30 calendar days after the award to it of the lower-tier construction subcontract, unless the construction subcontractor has submitted such a report within 12 months preceding the date of award of the lower-tier construction subcontract.

ARTICLE 13 - IMMIGRATION REFORM AND CONTROL ACT OF 1986 (STATE OF FLORIDA EXECUTIVE ORDER 11-116)

The Immigration Reform and Control Act of 1986 prohibits employers from knowingly hiring illegal workers. The Contractor shall only employ individuals who may legally work in the United States – either U.S. citizens or foreign citizens who are authorized to work in the U.S. The Contractor shall use the U.S. Department of Homeland Security’s E-Verify Employment Eligibility Verification system (<http://www.uscis.gov/portal/site/uscis>) to verify the employment eligibility of:

- all new employees, during the term of this Agreement, to perform employment duties within Florida; and,
- all new employees (including subcontractors and subrecipients) assigned by the Contractor to perform work pursuant to this Agreement.

The Contractor shall include this provision in all subcontracts/subgrants it enters into for the performance of work under this Agreement.

ARTICLE 14 – ENVIRONMENTAL COMPLIANCE

The Contractor, and all subcontractors at any tier, shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 U.S.C. 1857[h]), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738 (Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans).

ARTICLE 15 – FEDERAL LABOR STANDARDS PROVISION

Contracts being constructed with assistance from the State Revolving Fund Program are currently required to comply with the Federal Labor Standards Provisions as provided in Appendix C. Signing Appendix A certifies compliance with these provisions.

ARTICLE 16 – AMERICAN IRON AND STEEL PROVISION

Contracts being constructed with assistance from the State Revolving Fund Program are currently required to comply with The American Iron and Steel Provision as provided in Appendix D. Signing Appendix A certifies compliance with these provisions.

ARTICLE 17 - PROHIBITED LOCAL GOVERNMENT CONSTRUCTION PREFERENCES

- A. Pursuant to Section 255.0991, F.S., for a competitive solicitation for construction services in which 50 percent or more of the cost will be paid from state-appropriated funds which have been appropriated at the time of the competitive solicitation, a state, college, county, municipality, school district, or other political subdivision of the state may not use a local ordinance or regulation that provides a preference based upon:
1. The contractor’s maintaining an office or place of business within a particular local jurisdiction;
 2. The contractor’s hiring employees or subcontractors from within a particular local jurisdiction; or
 3. The contractor’s prior payment of local taxes, assessments, or duties within a particular local jurisdiction.
- B. For any competitive solicitation that meets the criteria in Paragraph A., a state college, county, municipality, school district, or other political subdivision of the state shall disclose in the solicitation document that any applicable local ordinance or regulation does not include any preference that is prohibited by Paragraph A.

**APPENDIX A TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS**

**CERTIFICATION OF COMPLIANCE WITH THE FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS**

This certification relates to a construction contract proposed by _____,
(insert the name of the Owner)

which expects to finance the proposed construction contract with assistance from the Florida Department of Environmental Protection (which administers a State Revolving Fund loan program supported in part with funds directly made available by grants from the United States Environmental Protection Agency). I am the undersigned prospective construction contractor or subcontractor.

I certify that I have read the Florida Department of Environmental Supplementary Conditions and agree to incorporate the following articles into the bid and/or contract:

- ARTICLE 11 DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)
- ARTICLE 12 EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)
- ARTICLE 13 IMMIGRATION REFORM AND CONTROL ACT OF (STATE OF FLORIDA EXECUTIVE ORDER 11-116)
- ARTICLE 14 ENVIRONMENTAL COMPLIANCE
- ARTICLE 15 FEDERAL LABOR STANDARDS PROVISION
- ARTICLE 16 AMERICAN IRON AND STEEL PROVISION

I agree that I will obtain identical certifications from prospective lower-tier construction subcontractors prior to the award of any lower-tier construction subcontracts with a price exceeding \$2,000. I also agree that I will retain such certifications in my files.

(Signature of Authorized Official)

(Date)

(Name and Title of Authorized Official [Print or Type])

(Name of Prospective Construction Contractor or Subcontractor [Print or Type])

(Address and Telephone Number of Prospective Construction Contractor or Subcontractor [Print or Type])

(Employer Identification Number of Prospective Construction Contractor or Subcontractor)

APPENDIX B TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

GOALS AND TIMETABLES FOR MINORITIES AND FEMALES

[Note: These goals and timetables are the goals and timetables referred to in Paragraph 2 of the "Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)"; these goals and timetables are to be included in all FDEP assisted construction contracts and subcontracts with a price exceeding \$10,000 and in all solicitations for such contracts and subcontracts.]

The following goals and timetables for female utilization shall be included in all federal and federally assisted construction contracts and subcontracts in excess of \$10,000. The goals are applicable to the contractor's aggregate on-site construction workforce whether or not part of that workforce is performing work on a federal or federally assisted construction contract or subcontract.

Area covered: Goals for Women apply nationwide.

Goals and Timetables

Timetable	Goals (percent)
Indefinite	6.9

Goals for minority utilization can be found in the Department of Labor's Technical Assistance Guide for Federal Construction Contractors (May 2009), available on the internet at <http://www.civilrightsusa.gov/pdf/TAG%20-%20Constuction.pdf> . These goals shall be included for each craft and trade in all federal or federally assisted construction contracts and subcontracts in excess of \$10,000 to be performed in the respective geographical areas. The goals are applicable to each nonexempt contractor's total onsite construction workforce, regardless of whether or not part of that workforce is performing work on a federal, federally assisted or non-federally related project, contract or subcontract.

Construction contractors which are participating in an approved Hometown Plan (see 41 CFR 60-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply with the applicable SMSA or EA goal contained in this Appendix.

APPENDIX C
TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS

Davis-Bacon Requirements

FEDERAL LABOR STANDARDS PROVISIONS

(Davis-Bacon Act, Copeland Act, and Contract Works Hours & Safety Standards Act)

The Project 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.

1 Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), 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 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 Part 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 Part 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) The sponsor, 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 FDEP shall approve a request for an additional classification and wage rate and fringe benefits; therefore, only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sponsor(s) 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 sponsor to the FDEP. The FDEP will transmit the request to the Administrator of the Wage and Hour Division, employment Standards Administration, U. S. Department of Labor. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional

classification action within 30 days of receipt and so advise the FDEP or will notify FEDP 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 that the Contractor, the laborers or mechanics to be employed in the Classification or their representatives, and the sponsor do not agree on the proposed classification and wage rate (including the amount designed for fringe benefits, where appropriate), the FDEP shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of FDEP, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary. (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)(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.

The sponsor shall, upon written request of the EPA 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 (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, EPA may, after written notice to the contractor, sponsor, applicant, or owners, 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 (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). 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 the sponsor. Such documentation shall be available upon request by FDEP. As to each payroll copy received, the sponsor shall provide a certification that the project is in compliance with the requirements of 29 CFR 5.5(a)(1) with each disbursement request. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR Part 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 <http://www.dol.gov/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 addresses of each covered worker, and shall provide them upon request to the sponsor for transmission to the FDEP or EPA if requested by EPA, the FDEP, 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 sponsor. (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 Part 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR Part 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 Option Form WH-347 shall satisfy the requirement for submission of the Statement of Compliance required by paragraph A. 3(ii)(b) of this section.

(d) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph A.3(I) of this section available for inspection, copying, or transcription by authorized representatives of the FDEP 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 FDEP may, after written notice to the contractor, or sponsor, 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 to make such records available may be grounds for debarment action pursuant to 29 CFR Part 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, the 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 the 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, the 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 contract 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 will insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 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 referenced 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 the sponsor, FDEP, 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) or to be awarded EPA contracts or participate in EPA programs pursuant to Executive Order 12549.

(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 EPA contracts or participate in EPA programs pursuant to Executive Order 12549.

(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 1010, 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.

A. 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 sponsor shall insert the following clauses set forth in paragraphs B.(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by item 3 above or 29 CFR 4.6. As used in the paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in 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 forty 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. The sponsor, upon written request of the FDEP or an authorized representative of the Department of Labor, may 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

(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 (formerly part 1518) 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 State 96).

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

12. Guidance to Contractor for Compliance with Labor Standards Provisions

a) Contracts with Two Wage Decisions

If the contract includes two wage decisions, the contractor, and each subcontractor who works on the site, must submit either two separate payrolls (one for each wage decision) or one payroll which identifies each worker twice and the hours worked under each wage decision. One single payroll, reflecting each worker once, may be submitted provided the Contractor uses the higher rate in the wage decisions for each identical job classification. However, where a job classification is not listed in a wage decision and is needed for that portion of the work, the classification **must** be added to the wage decision. A worker may not be paid at the rate for a classification using the hourly rate for that same classification in another wage decision. After the additional classification is approved, the contractor may pay the higher of the two rates and submit one payroll, if desired.

b) Complying with Minimum Hourly Amounts

1) The minimum hourly amount due to a worker in each classification is the total of the amounts in the Rates and Fringe Benefits (if any) columns of the applicable wage decision.

2) The contractor may satisfy this minimum hourly amount by any combination of cash and bona fide fringe benefits, regardless of the individual amounts reflected in the Rates and Fringe Benefits columns.

3) A contractor payment for a worker which is required by law is not a fringe benefit in meeting the minimum hourly amount due under the applicable wage decision. For example, contractor payments for FICA or unemployment insurance are not a fringe benefit; however, contractor payments for health insurance or retirement are a fringe benefit. Generally, a fringe benefit is bona fide if (a) it is available to most workers and (b) involves payments to a third party.

4) The hourly value of the fringe benefit is calculated by dividing the contractor's annual cost (excluding any amount contributed by the worker) for the fringe benefit by 2080. Therefore, for workers with overtime, an additional payment may be required to meet the minimum hourly wages since generally fringe benefits have no value for any time worked over 40 hours weekly. (If a worker is paid more than the minimum rates required by the wage decision, this should not be a problem. As long as the total wages received by a worker for straight time equals the hours worked times the minimum hourly rate in the wage decision, the requirement of the Davis-Bacon and Related Acts has been satisfied.)

c) Overtime

For any project work over 40 hours weekly, a worker generally must be paid 150% of the actual hourly cash rate received, not the minimum required by the wage decision. (The Davis-Bacon and Related Acts only establishes minimum rates and does not address overtime. The Contract Work Hours Act contains the overtime requirement and uses basic rate of pay as the base for calculation, not the minimum rates established by the Davis-Bacon and Related Acts.)

d) Deductions

Workers who have deductions, not required by law, from their pay must authorize these deductions in writing. The authorization must identify the purpose of each deduction and the amount, which may be a specific dollar amount or a percentage. A copy of the authorization must be submitted with the first payroll containing the deduction. If deducted amounts increase, another authorization must be submitted. If deducted amounts decrease, no revision to the original authorization is needed. Court-ordered deductions, such as child support, may be identified by the responsible payroll person in a separate document. This document should identify the worker, the amount deducted and the purpose. A copy of the court order should be submitted.

e) Classifications Not Included in the Wage Decision

If a classification not in the wage decision is required, please advise the owner's representative in writing and identify the job classification(s) required. In some instances, the state agency may allow the use of a similar classification in the wage decision.

Otherwise, the contractor and affected workers must agree on a minimum rate, which cannot be lower than the lowest rate for any trade in the wage decision. Laborers (including any subcategory of the laborer classification) and truck drivers are not considered a trade for this purpose. If the classification involves a power equipment operator, the minimum cannot be lower than the lowest rate for any power equipment operator in the wage decision. The owner will provide forms to document agreement on the minimum rate by the affected workers and contractor.

The U.S. Department of Labor (USDOL) must approve the proposed classification and rate. The contractor may pay the proposed rate until the USDOL makes a determination. Should the USDOL require a higher rate, the contractor must make wage restitution to the affected worker(s) for all hours worked under the proposed rate.

f) Supervisory Personnel

Foremen and other supervisory personnel who spend at least 80% of their time supervising workers are not covered by the Davis-Bacon and Related Acts. Therefore, a wage decision will not include such supervisory classifications and their wages are not subject to any minimums under the Davis-Bacon and Related Act or overtime payments under the Contract Work Hours and Safety Standards Act. However, foremen and other supervisory personnel who spend less than 80% of their time engaged in supervisory activities are considered workers/mechanics for the time spent engaged in manual labor and must be paid at least the minimum in the wage decision for the appropriate classification(s) based on the work performed.

g) Sole Proprietorships / Independent Contractors / Leased Workers

The nature of the relationship between a prime contractor and a worker does not affect the requirement to comply with the labor standards provisions of this contract. The applicability of the labor standards provisions is based on the nature of the work performed.

If the work performed is primarily manual in nature, the worker is subject to the labor standards provisions in this contract. For example, if John Smith is the owner of ABC Plumbing and performs all plumbing work himself, then Mr. Smith is subject to the labor standards provisions, including minimum wages and overtime. His status as owner is irrelevant for labor standards purposes.

If a worker meets the IRS standards for being an independent contractor, and is employed as such, this means that the worker must submit a separate payroll as a subcontractor rather than be included on some other payroll. The worker is still subject to the labor standards provisions in this contract, including minimum wages and overtime.

If a contractor or subcontractor leases its workers, they are subject to the labor standards provisions in this contract, including minimum wages and overtime. The leasing firm must submit payrolls and these payrolls must reflect information required to determine compliance with the labor standards provisions of this contract, including a classification for each worker based on the nature of the work performed, number of regular hours worked, and number of overtime hours worked.

h) Apprentices / Helpers

A worker may be classified as an apprentice **only if participating in a federal or state program**. Documentation of participation must be submitted. Generally, the apprentice program specifies that the apprentice will be compensated at a percentage of journeyman rate. For Davis-Bacon Act purposes, the hourly rate cannot be lower than the percentage of the hourly rate for the classification in the applicable wage decision.

If the worker does not participate in a federal or state apprentice program, then the worker must be classified according to duties performed. This procedure may require classification in the trade depending on tools used, or as a laborer if specialized tools of the trade are not used. The contractor may want to consult with the Wage and Hour Division of the U.S. Department of Labor located in most large cities regarding the appropriate classification.

Presently, no worker may be classified as a helper. As with apprentices not participating in a formal apprentice program, the worker must be classified according to duties performed and tools used.

APPENDIX D TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

American Iron and Steel Requirement

The Contractor acknowledges to and for the benefit of the _____ ("Owner") and the State of Florida (the "State") that it understands that iron and steel products to be installed as a part of this contract must be in compliance with the requirements in H.R. 3547, "Consolidated Appropriations Act, 2014," (Appropriations Act). H.R. 3547 includes the following language in Division G, Title IV, Sec. 436, under the heading, "Use of American Iron and Steel,":

(a) (1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the "Administrator") finds that--

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

For waivers to these requirements based on (2)(b) above, contact Sheryl Parsons at USEPA Region IV. She can be reached by phone at (404) 562-9337.

Section 810

"General Decision Number: FL20200139 01/03/2020

Superseded General Decision Number: FL20190139

State: Florida

Construction Type: Heavy

Counties: Pasco and Pinellas Counties in Florida.

HEAVY CONSTRUCTION PROJECTS (Including Sewer and Water Lines)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.80 for calendar year 2020 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, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.80 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 calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2020

* ELEC0915-003 12/01/2019

	Rates	Fringes
ELECTRICIAN.....	\$ 30.01	39%+0.35

ENGI0925-010 06/01/2013

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Crawler Cranes; Truck		
Cranes; Pile Driver		
Cranes; Rough Terrain		
Cranes; and Any Crane not		

otherwise described below...	\$ 29.61	11.50
Drill.....	\$ 29.61	11.50
Hydraulic Cranes Rated 100 Tons or Above but Less Than 250 Tons; and Lattice Boom Cranes Less Than 150 Tons if not described below.	\$ 30.61	11.50
Lattice Boom Cranes Rated at 150 Tons or Above; Friction Cranes of Any Size; Mobile Tower Cranes or Luffing Boom Cranes of Any Size; Electric Tower Cranes; Hydraulic Cranes Rated at 250 Tons or Above; and Any Crane Equipped with 300 Foot or More of Any Boom Combination.....	\$ 31.61	11.50
Oiler.....	\$ 22.91	11.50

IRON0397-006 07/01/2019

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 30.85	16.47

LAB00517-002 05/01/2017

	Rates	Fringes
LABORER: Grade Checker.....	\$ 19.20	7.85

PAIN0088-008 08/01/2019

	Rates	Fringes
PAINTER: Brush, Roller and Spray.....	\$ 20.21	11.28

SUFL2009-178 06/24/2009

	Rates	Fringes
CARPENTER.....	\$ 14.95	2.92
CEMENT MASON/CONCRETE FINISHER...	\$ 14.77	3.50
LABORER: Common or General.....	\$ 9.26	0.00
LABORER: Landscape.....	\$ 7.25	0.00
LABORER: Pipelayer.....	\$ 11.33	0.00
LABORER: Power Tool Operator (Hand Held Drills/Saws, Jackhammer and Power Saws Only).....	\$ 10.63	2.20
OPERATOR: Asphalt Paver.....	\$ 11.59	0.00
OPERATOR: Backhoe Loader		

Combo.....	\$ 16.10	2.44
OPERATOR: Backhoe/Excavator.....	\$ 15.60	0.00
OPERATOR: Bulldozer.....	\$ 17.00	0.00
OPERATOR: Grader/Blade.....	\$ 16.00	2.84
OPERATOR: Loader.....	\$ 14.75	0.00
OPERATOR: Mechanic.....	\$ 14.32	0.00
OPERATOR: Roller.....	\$ 10.76	0.00
OPERATOR: Scraper.....	\$ 11.00	1.74
OPERATOR: Trackhoe.....	\$ 20.92	5.50
OPERATOR: Tractor.....	\$ 10.54	0.00
TRUCK DRIVER, Includes Dump		
Truck.....	\$ 11.00	0.00
TRUCK DRIVER: Lowboy Truck.....	\$ 12.73	0.00
TRUCK DRIVER: Off the Road		
Truck.....	\$ 12.21	1.97

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 www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (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 Regional Office for the area in which the survey was conducted because those Regional Offices have 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 DECISION

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SECTION 01100

SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: The work under this project consists of a improvements to an existing potable water facility in accordance with these contract documents.
 - 1. Project Location: The Tank Hill Water Facility off of Skyline Drive north of St Joe Road and west of 21st Street, as further identified in the plans.
 - 2. Owner: City of Dade City
- B. Engineer Identification: The Contract Documents were prepared for this Project by Infrastructure Solution Services LLC, 7185 Murrell Road, Suite 101, Melbourne, FL, 32940.
- C. The Work under this contract includes the following:
 - 1. Installation of a new water supply well approximately 500 feet in depth.
 - 2. Installation of a new deep well vertical turbine pump with associated piping, appurtenances and well pad.
 - 3. Construction of a new elevated storage tank.
 - 4. Installation of two new booster pumps and hydropneumatic tank.
 - 5. Installation of a new sodium hypochlorite feed system.
 - 6. Miscellaneous site work.
 - 7. Electrical and instrumentation modifications.
 - 8. Off-site work including abandonment of two water facilities and installation of three (3) pressure reducing valves in the water distribution system.
- D. CONTRACT
 - 1. Project will be constructed under one contract.

1.3 WORK SEQUENCE

- A. Any and all work necessary will be coordinated with City staff for site access and necessary shut downs or temporary operational changes to the existing facility.

1.4 CONTRACTORS USE OF PREMISES

- A. General: The Contractor shall limit his use of the premises to the work indicated.
- B. Use of the Site: Confine operations to rights-of-way. Storage of materials or equipment beyond areas on which work is indicated is not permitted.
 - 1. Keep existing driveways and entrances clear and available at all times. Do not use these areas for parking or storage of materials.
- C. Coordinate use of premises under direction of the Owner and Engineer.
- D. Assume full responsibility for the protection and safe-keeping of products under this Contract, stored on the site.
- E. Move any stored products, under Contractor's control, which interfere with operations of the Owner or separate Contractor.
- F. Obtain and pay for the use of additional storage or work areas needed for operations.

1.5 WORK UNDER OTHER CONTRACTS

- A. Separate Contract: Owner may award separate contracts for performance of certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
- B. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.6 OWNER OCCUPANCY

- A. Owner will need access to the project site during the entire period of construction. Coordinate and cooperate with Engineer in all construction operations to minimize conflict and to facilitate Owner usage.
- B. Contractor shall at all times conduct his operations so as to insure the least inconvenience to the general public.

1.7 STORAGE OF EQUIPMENT AND MATERIALS

- A. The use of City facilities for the storage of equipment and/or materials shall not be permitted. Contractor shall obtain storage facilities for materials and equipment at his own expense.

1.8 WORK ON PRIVATE PROPERTY

- A. Contractor shall obtain Owner permission before performing work on private property. Permission shall be obtained at least 48 hours in advance of work. If the work is going to be extensive or require restoration, the Contractor shall notify the City in advance and written permission must be obtained through the City before work can be started. The Contractor shall photograph the work area before commencing work on private property and provide a copy to the City.

1.9 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by workmen.

1.10 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the Engineer. The costs for such test pits shall be borne by the Contractor.

1.11 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

1.12 COOPERATION WITHIN THIS CONTRACT

- A. The Contractor shall, prior to interrupting a utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the Owner and make arrangements for the interruption which will be satisfactory to the Owner.

1.13 REQUIRED INSURANCE AND LIABILITY

- A. Should any damage from the Contractor's operations occur, the City will investigate claims and notify the Contractor and the damaged party as to its findings. The Contractor shall be responsible for any damages caused by his operations.

1.14 SAFETY AND OSHA COMPLIANCE

- A. The Contractor shall comply in all respects with all Federal, State, and Local safety, health, and traffic control regulations. Copies of the Federal regulations may be obtained from the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), Washington DC 20210 or their regional offices. Particular attention is drawn to safety requirements for handling chemicals and entering confined spaces.
- B. The Contractor shall comply in all respects with the applicable Workman's Compensation Laws.

1.15 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
- B. 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. 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.
- C. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work.

Products and Execution modify and supplement these by detailed requirements of the work and shall always govern whenever there appears to be a conflict.

- D. Intent: All work called for in the Specifications applicable to this Contract, but not shown on the plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the plans or the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work is required and shall be performed by the Contractor as though it were specifically delineated or described.
 - 1. The apparent silence of the specifications 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, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these specifications shall be made upon that basis. The inclusion of the General Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.16 PERMITS

- A. It shall be the CONTRACTOR's responsibility to secure all permits required to initiate and complete the Work under this Contract, except permits obtained by the OWNER. Anticipated permits to be obtained by CONTRACTOR include the following:
 - 1. Building Permit
- B. Permits obtained, or to be obtained, by the OWNER include the following:
 - 1. SWFWMD Water Use Permit (#1631.010) authorizing withdrawal of groundwater.
 - 2. FDEP Application to Construct Potable Water System Components

PART 2 - PRODUCTS

2.1 SALVAGED MATERIALS

- A. In the absence of special provisions to the Contract, salvaged materials, equipment or supplies that occur are the property of the Owner and shall be cleaned, stored and delivered to the Owner as directed by the Engineer.

2.2 CERTIFIED CHEMICALS

- A. All chemicals used during project construction or furnished for project whether herbicide, pesticide, disinfectant, polymer, reactant, chemical grout or other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residue shall be in strict conformance with instructions.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall, prior to entering any section, prepare a Pre-Construction video and/or digital photographs, in accordance with Section 01380 PRECONSTRUCTION DOCUMENTATION, of each property and surrounding area to determine existing site conditions. Together the video and/or photographs will provide the basis for the level of restoration required and to address claims made against Contractor for damages caused.
- B. The Contractor shall notify all property owners 48 hours prior to working in public Rights-of-Way or easements affecting or adjoining their properties. Notification shall be by hand-delivered flyer (prior Engineer approval required) which shall contain the following information:
 - 1. Project Name
 - 2. Date of Entry
 - 3. Description of Work
 - 4. Name of Contractor's Representative
 - 5. Local Phone Number of Contractor's Representative
- C. The Contractor shall, prior to the removal of any fences, erect temporary fences to secure the owner's property. These temporary fences shall be of 4' high woven wire (2" x 4" grid), on the T line post 10' on centers. These fences shall run along the easement line and will remain in place until the permanent fence is re-erected.

3.2 CONNECTIONS TO EXISTING LINES

- A. Where connecting to existing lines, it shall be done at such a time in such a manner to cause the least amount of interruption to City operations and customer services.

END OF SECTION 01100

SECTION 01140
CONTROL OF WORK

PART 1 - GENERAL

1.1 CONSTRUCTION AREAS

- A. Coordinate use of work site under direction of Engineer and/or Owner.
- B. Assume full responsibility for the protection and safekeeping of materials and products under this Contract, stored on the site.
- C. Move stored products, under Contractor's control, which interfere with operations of the Owner or separate contractor.
- D. Obtain and pay for the use of additional storage of work areas needed for operations.

1.2 PRIVATE LAND

- A. The Contractor shall not enter or occupy private land outside of the Owner's property, public right-of way, or other easements, except by permission of the land owner.

1.3 WORK LOCATIONS

- A. Structures and pipelines shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him/her from laying and jointing different or additional items where required.

1.4 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his/her own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions. The Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.
- C. The Contractor shall adhere to the requirements of the Florida Trench Safety Act, and O.S.H.A. Excavation Safety Standards 29 CFRs 1926.650 Subpart P.

1.5 TEST PITS

- A. Test pits for the purpose of locating all known and unknown underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer. No separate payment will be made.

1.6 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his/her expense, to a condition similar or equal to that existing before the damage was done, or he/she shall make good the damage in other manner acceptable to the Engineer.
- B. Along the location of this work all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in the location indicated by the Engineer as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be re-graded and seeded.
- C. The protection, removal, and replacement of existing physical features along the line of work shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Schedule of Values.

1.7 PROTECTION/RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, storm drains and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind.

Any damage resulting from the Contractor's operations shall be repaired by him/her at his/her expense.

- B. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Total Bid Price in the Bid Form.
- D. The Contractor shall be responsible to maintain water, telephone, power, cable TV, sewer, gas and other related utilities throughout construction at no additional cost to the Owner.
- E. The Contractor shall fully cooperate with all private and public utilities during the installation of new facilities, or relocation of existing facilities. The Contractor shall coordinate his work accordingly and shall have no claim except for time extension for delays associated with the proposed utility improvements.

1.8 WATER FOR CONSTRUCTION PURPOSES

- A. The Contractor shall at his/her own cost, provide for the continuous operation of sewers, force mains, drains, and water mains during the progress of the work. The Contractor shall provide temporary services and/or bypasses when necessary to provide continuous utility service.
- B. Contractor shall be responsible for obtaining any water necessary for construction through the City of Dade City.

1.9 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

- A. During the course of the work, the Contractor shall keep the site of his/her operations in as clean and neat a condition as is possible. He/She shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he/she shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his/her subcontractors shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

- C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor, or Subcontractor, will be brought to the immediate attention of the responsible regulatory agencies. The Contractor shall be responsible for any action ordered by the regulatory agency.

1.10 MAINTENANCE OF ACCESS

- A. Portions of the work are located in developed areas requiring the access for fire and other departments to be provided for and at least one free lane be available for all traffic. Contractor is to arrange operations in these areas to meet these requirements and secure approval or operating procedures from the local traffic authority.

1.11 MAINTENANCE OF TRAFFIC

- A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage.
- B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.
- C. Detours around construction areas will be subject to the approval of the Owner. Where detours are permitted the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured the Contractor shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the Owner.

PART 2 - PRODUCTS

2.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.
- B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the

Contractor at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.

- C. The Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.
- D. The Contractor shall maintain the work during construction and until the project is accepted. This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the road or structures are kept in satisfactory condition at all times. In the case of a Contract for the placing of a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.
- E. All cost of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various pay items and the Contractor will not be paid an additional amount for such work.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01140

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SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Division 1 Section "Closeout Procedures" for administrative requirements governing project closeout.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Engineer at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.

- B. Format and Content: Use the bid form and/or specifications table of contents as a guide to establish line items for the Schedule of Values.
1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Engineer and Engineer's project number.
 - c. Contractor's name and address.
 - d. Date of submittal.
 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
 3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 4. 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. If specified, include evidence of insurance or bonded warehousing.
 5. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
 6. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- C. Schedule of Values Form: Use form provided at the end of this Section for Schedule of Values. Contractor may use their own form provided such form is approved by both the Owner and Engineer.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Progress payments shall be submitted to Engineer by the 5th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- C. Payment Application Forms: Use form provided at the end of this Section for Applications for Payment. Contractor may use their own form provided such form is approved by both the Owner and Engineer.

- 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 of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Engineer. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
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 final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. Schedule of Values.
 2. Contractor's Construction Schedule (preliminary if not final).
 3. Submittals Schedule (preliminary if not final).
 4. Certificates of insurance and insurance policies.
 5. Performance and payment bonds.
- H. Application for Payment at Substantial Completion: After issuing 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 Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: 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. Evidence that claims have been settled.
5. 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.
6. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

3.1 BASE BID ITEMS

- A. Bid Item No. 1 – Mobilization and Demobilization
 1. Price for mobilization and demobilization shall not exceed five (5) percent of the total contract price.
 2. Payment for the mobilization and demobilization shall be limited to thirty (30) percent at the first payment application and ten (10) percent at the final pay application. The remaining sixty (60) percent shall be divided among the three pay applications following the initial pay application.
- B. Bid Item No. 2 – Administrative
 1. Administrative tasks such as permits, shop drawings, invoices, bonds, insurance, survey, record drawings, etc. shall be included in this bid item and shall not exceed ten (10) percent of the total contract price.
 2. Payment for the administrative tasks shall be divided among the pay applications.
- C. Bid Item No. 3 – Site Work
 1. Site Work shall include the new access road, fencing with access gate(s), stormwater pond and structures, fill, grading, sodding, etc. as shown on the Plans and outlined in the Specifications.
 2. Site Work shall be paid on a lump sum basis for the percent of work completed.
- D. Bid Item No. 4 – Well Drilling Services
 1. Well Drilling Services shall include construction of the new groundwater supply well and abandonment of existing wells. This bid items shall include all associated testing, well permitting, reporting, etc. as shown on the Plans and outlined in the Specifications. A separate table is included on the bid form to develop this cost based on unit prices bid for estimated quantities of work to be performed.
 2. Well Drilling Services shall be paid on a unit price basis for the actual quantities of work completed.

- E. Bid Item No. 5 – Well Outfitting
 - 1. The Well Outfitting bid item shall include furnishing and installing the vertical turbine pump, discharge piping, appurtenances, well pad, supports, and other ancillary items as shown on the Plans and outlined in the Specifications.
 - 2. Well Outfitting shall be paid on a lump sum basis for the percent of work completed.
- F. Bid Item No. 6 –Booster Pumps and Hydropneumatic Tank
 - 1. The Booster Pumps and Hydropneumatic Tank bid item shall include furnishing and installing the end suction pumps, hydropneumatic tank and accessories, suction and discharge piping, concrete slab, roof structure, appurtenances, supports, and other ancillary items as shown on the Plans and outlined in the Specifications.
 - 2. Booster Pumps and Hydropneumatic Tank shall be paid on a lump sum basis for the percent of work completed.
- G. Bid Item No. 7 – NaOCl Storage and Feed System
 - 1. The NaOCl Storage and Feed System bid item shall include furnishing and installing the NaOCl chemical feed system skid, eye/facewash station, floor drain, containment structure, roof structure, piping, appurtenances, and other ancillary items as shown on the Plans and outlined in the Specifications. Bid item shall also include installation of Owner supplied bulk storage tank.
 - 2. NaOCl Storage and Feed System shall be paid on a lump sum basis for the percent of work completed.
- H. Bid Item No. 8 – Elevated Storage Tank and Foundation
 - 1. The Elevated Storage Tank and Foundation shall include all work for the construction of the elevated tank, foundation, piping, coatings, disinfection, start-up, testing, accessories, etc. as shown on the Plans and outlined in the Specifications.
 - 2. Elevated Storage Tank and Foundation shall be paid on a lump sum basis for the percent of work completed.
- I. Bid Item No. 9 – Electrical
 - 1. Electrical work shall include all equipment, materials, conduit, wiring, etc. to complete work as shown on the Plans and outlined in the Specifications.
 - 2. Electrical shall be paid on a lump sum basis for the percent of work completed.
- J. Bid Item No. 10 – Instrumentation
 - 1. Instrumentation work shall include furnishing and installing all instrumentation equipment, conduit, wiring, etc. as provided in the Plans and outlined in the Specifications.
 - 2. Instrumentation shall be paid on a lump sum basis for the percent of work completed.
- K. Bid Item No. 11 – SCADA System Integration Allowance

1. SCADA System Integration shall include all PLC equipment, software, programming, etc. to modify the existing SCADA system to include the new equipment and operational procedures as provided in the Contract Documents. The allowance shall also include incorporation of the proposed improvements with the overall operation of the Owner's water system.
 2. SCADA System Integration shall be paid for all materials, labor, supervision, tools, equipment, supplies, and incidentals necessary to complete the work outlined in the Contract Documents and authorized by the Engineer or Owner.
- L. Bid Item No. 12 – Demolition and Off-Site Work
1. Demolition and Off-Site Work shall include demolition of the existing Tank Hill Storage Tank, pumping, hydropneumatic tank, piping, structures, etc. as depicted on the Plans and outlined in the Specifications.
 2. Demolition work shall also include demolition of tankage, electrical equipment, piping, etc. at the College Heights and Sally Road well sites. Other off-site work shall include the installation of three (3) pressure reducing valves at the location shown on the Drawings and described in the Specifications.
 3. Demolition and Off-Site Work shall be paid on a lump sum basis for the percent of work completed.

SCHEDULE OF VALUES FORM

Project Name: _____

Pay Application No. _____

[illegible]

SCHEDULE OF VALUES FORM (CONTINUED)

Project Name: _____

Pay Application No. _____

[illegible]

APPLICATION AND CERTIFICATE FOR PAYMENT

Project Name: _____ Original Contract Sum: \$ _____

Owner: _____ Contractor: _____

Application No: _____ Owner's Project No.: _____
Period From: _____ Contractor's Project No.: _____
Period To: _____ Engineer's Project No.: _____

Application is made for payment, as detailed on the following page(s), of: \$ _____

The undersigned Contractor certifies that to the best of his knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work done on previous applications for payment for which payments have been received from the Owner, and that the current payment shown herein is now due.

CONTRACTOR: _____

By: _____ Date: _____
_____ (print)

COUNTY OF _____ STATE OF _____

Before me on this _____ day of _____, 20____, personally appeared _____, known to me, who being duly sworn, deposes and says that (s)he is the _____ of the Contractor above mentioned; that(s) he executed the above Application for Payment and statement on behalf of said Contractor; and that all of the statements contained therein are true, correct and complete.

(Notary Public)
My Commission Expires _____

OWNER: _____

By: _____ Date: _____ By: _____ Date: _____
_____ (print) _____ (print)

ENGINEER: _____

Amount Certified: \$ _____ By: _____ Date: _____
_____ (print)

Explanation (if different from amount shown): _____

Change Order Summary:

Previously Approved Change Orders			
		<u>Additions</u>	<u>Deductions</u>
Total		\$ _____	\$ _____

Change Orders Approved This Pay Period			
<u>Change Order No.</u>	<u>Date Approved</u>	<u>Additions</u>	<u>Deductions</u>
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
Total This Pay Period		\$ _____	\$ _____
Net Change (Current plus previous change orders)		\$ _____	\$ _____

Net Change Order		\$ _____

Application is made for payment as shown below:

1. ORIGINAL CONTRACT SUM	\$ _____
2. Net Change by Change Order	\$ _____
3. CONTRACT SUM TO DATE (Line 1 and 2)	\$ _____
4. TOTAL COMPLETED AND STORED TO DATE	\$ _____
5. RETAINAGE:	
a. _____% of Completed Work	\$ _____
b. _____% of Stored Material	\$ _____
c. Total Retainage (Line 5a and 5b)	\$ _____
6. TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5c)	\$ _____
7. LESS PREVIOUS PAYMENTS (Line 6 from prior Certificate)	\$ _____
8. AMOUNT DUE THIS APPLICATION	\$ _____
9. BALANCE TO FINISH, PLUS RETAINAGE (Line 3 less Line 6)	\$ _____

END OF SECTION 01290

SECTION 01250

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Engineer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Engineer are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within ten (10) after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Engineer.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Engineer may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250

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SECTION 01310

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Interpretation (RFIs).
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required

maintenance, service, and repair of all components, including mechanical and electrical.

- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Pre-installation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within five (5) days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- C. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
 - 1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be

represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

1.6 REQUESTS FOR INTERPRETATION (RFI)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form provided at the end of this Section.
 - 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Contractor.
 - 4. Name of Engineer.
 - 5. RFI number, numbered sequentially.
 - 6. Specification Section number and title and related paragraphs, as appropriate.
 - 7. Drawing number and detail references, as appropriate.
 - 8. Field dimensions and conditions, as appropriate.
 - 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 10. Contractor's signature.
 - 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs:
 - 1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form, with substantially the same content as indicated above and shown on the form provided at the end of this Section, may be used by the Contractor. Form shall be approved by Engineer prior to use.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Engineer's Action: Engineer will review each RFI, determine action required, and return it. Allow seven (7) working days for Engineer's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Engineer's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
2. Engineer's action may include a request for additional information, in which case Engineer's time for response will start again.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within ten (10) days of receipt of the RFI response.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

CONTRACTOR REQUEST FOR INFORMATION (RFI) FORM

RFI NO. _____

OWNER:	<u>City of Dade City</u>	No. Copies _____
ENGINEER:	<u>Infrastructure Solution Services</u>	No. Copies _____
ARCHITECT:	_____	No. Copies _____
CONTRACTOR:	_____	No. Copies _____
OTHER:	_____	No. Copies _____

PROJECT DATA

NAME: _____
LOCATION: _____
OWNER: _____
OTHER: _____

CONTRACT DATA

NUMBER: _____
DATE: _____
DRAWING NO: _____
SPEC SECTION: _____

QUESTION:

BY: _____ DATE: _____

REPLY:

BY: _____ DATE: _____

END OF SECTION 01310

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. The CONTRACTOR shall submit to the ENGINEER for review such working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this Section called data), and material samples (hereinafter in this Section called samples) as are required for the proper control of work, including but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.
- B. The CONTRACTOR shall note that there are specific submittal requirements in other sections of these Specifications.
- C. The CONTRACTOR is to maintain an accurate updated submittal log and shall bring this log to each scheduled progress meeting with the OWNER and the ENGINEER. This log should include the following items:
 - 1. Submittal-Description and File Number assigned.
 - 2. Date to ENGINEER.
 - 3. Date returned to CONTRACTOR (from ENGINEER).
 - 4. Status of Submittal
 - a. Reviewed
 - b. Furnish as Corrected
 - c. Revise and Resubmit
 - d. Submit Specific Item
 - e. Rejected
 - 5. Date of Resubmittal and Return (as applicable).
 - 6. Date material released (for fabrication).
 - 7. Projected date of fabrication.
 - 8. Projected date of delivery to site.
 - 9. Status of O&M submittal

1.2 SHOP DRAWINGS

- A. When used in the Contract Documents, the term "shop drawings" shall be considered to mean CONTRACTOR's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale

drawings, bills of material, wiring and control diagrams, and inspection and test reports including performance curves and certifications as applicable to the Work.

- B. All details on shop drawings submitted for approval shall show clearly the elevations of the various parts to the main members and lines of the structure and/or equipment, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the shop drawings before being submitted for approval.
- C. See Shop Drawing Schedule requirements in subparagraph 1.7 CONTRACTOR'S RESPONSIBILITY.

1.3 PRODUCT DATA

- A. Product data as specified in individual sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, MANUFACTURER'S printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing storage instructions, and printed product warranties, as applicable to the work.

1.4 WORKING DRAWINGS

- A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the CONTRACTOR's plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework; for underpinning; and for such other work as may be required for construction but does not become an integral part of the Project.
- B. Working drawings shall be signed and sealed by a registered Professional Engineer, currently licensed to practice in the State and shall convey, or be accompanied by, calculations or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the ENGINEER. Such review will be for general conformance and will not relieve the CONTRACTOR in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the CONTRACTOR; the OWNER and ENGINEER shall have no responsibility therefor.

1.5 SAMPLES

- A. The CONTRACTOR shall furnish, for the approval of the ENGINEER, samples required by the Contract Documents or requested by the ENGINEER. Samples shall be delivered to the ENGINEER as specified or requested and in quantities and sizes as specified. A minimum of two samples of each item shall be submitted unless otherwise specified. The CONTRACTOR shall pre-pay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until approved by the ENGINEER.
- B. Samples specified in individual sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the ENGINEER or OWNER for independent inspection and testing, as applicable to the Work.
- C. The CONTRACTOR shall prepare a transmittal letter in triplicate for each shipment of samples. The CONTRACTOR shall enclose a copy of this letter with the shipment and send a copy of this letter to the ENGINEER. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.
- D. Approved samples not destroyed in testing shall be sent to the ENGINEER or stored at the site of the work. Materials and equipment incorporated in work shall match the approved samples. Samples which fail testing or are not approved will be returned to the CONTRACTOR at his expense, if so requested at time of submission.

1.6 SUBMITTAL REQUIREMENTS

- A. The CONTRACTOR shall review, approve, and submit, with reasonable promptness and in such sequence as shown on the Shop Drawing Submittal Schedule so as to cause no delay in the Contract Work or in the Work of the OWNER or any separate contractor, all shop drawings, product data, working drawings and samples required by the Contract Documents.
- B. The CONTRACTOR shall submit electronically one digital copy of the submittal in pdf version and four (4) printed copies of all shop drawings for the ENGINEER to review, of which the ENGINEER will retain two (2) sets.
- C. All submittals shall be made directly to the ENGINEER.
- D. Shop drawings, product data, working drawings and samples shall be furnished with the following information:
 - 1. Number and title of the drawing.
 - 2. Date of drawing or revision.

3. Name of project building or facility.
 4. Name of contractor, subcontractor, and manufacturer submitting drawing.
 5. Clear identification of contents, location of the work, and the sheet numbers and specification section where the product is found in the contract drawings.
 6. CONTRACTOR Certification Statement.
 7. Submittal Number.
 8. Contract Drawing Number Reference.
- E. In accordance with subparagraph 1.7 A, each shop drawing, working drawing, sample, and catalog data submitted by the CONTRACTOR shall have affixed to it the following Certification Statement, signed by the CONTRACTOR:
1. "Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all CONTRACTOR requirements."
- F. All items specified are not necessarily intended to be a manufacturer's standard product. Variations from specified items will be considered on an "or equal" basis. If submittals show variations from Contract requirements because of standard shop practice or for other reasons, the CONTRACTOR shall describe such variations in his letter of transmittal and on the shop drawings along with notification of his intent to seek contract adjustment. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the CONTRACTOR fails to describe such variations he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed. Variations submitted but not described may be cause for rejection. Any variations initiated by the CONTRACTOR will not be considered as an addition to the scope of work unless specifically noted and then approved as such in writing by the ENGINEER.
- G. Data on materials and equipment shall include materials and equipment lists giving, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, material, size, finish, and all other pertinent data.
- H. For all mechanical and electrical equipment furnished, the CONTRACTOR shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted as specified in Section 01730.
- I. All MANUFACTURERS or equipment suppliers who propose to furnish equipment or products under Divisions 11, 13, 14, 15 and 16 shall submit an installation list to the ENGINEER along with the required shop drawings. The installation list shall include all installations where identical equipment has been installed and has been in operation for a period of at least one (1) year.

- J. The CONTRACTOR shall use the color "green" to make his remarks on the Submittals. Only the ENGINEER will utilize the color "red" in marking submittals.
- K. Facsimiles or copies of facsimiles will not be accepted for review.

1.7 CONTRACTOR'S RESPONSIBILITY

- A. It is the duty of the CONTRACTOR to check, and coordinate with the work of all trades, all drawings, data, schedules and samples prepared by or for him before submitting them to the ENGINEER for review. Each and every copy of any drawing or data sheet larger than 11"x17" shall bear CONTRACTOR's stamp showing that they have been so checked and approved. Drawings or data sheets 11"x17" and smaller shall be bound together in an orderly fashion and bear the CONTRACTOR's stamp on the cover sheet. The cover sheet shall fully describe the packaged data and include a list of all sheet numbers within the package. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR, without review at the ENGINEER's option, for conformance with this requirement.
- B. The CONTRACTOR shall review shop drawings, product data, and samples prior to submission to determine and verify the following:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Manufacturer's catalog numbers and similar data.
 - 4. Conformance with Specifications.
- C. Deviations from the Specifications or Drawings
 - 1. Shop drawings shall indicate any deviations in the submittal from the requirements of the Contract Documents. If no exceptions are taken to the specifications or drawings, the Contractor (or any Subcontractor, Manufacturer, etc.) shall make a statement as such. If there is no statement included in the submittal, then it is acknowledged that no exceptions are taken.
 - 2. Exceptions to the Specifications and/or Drawings shall be clearly defined in a Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the Engineer.
 - 3. Exceptions in the submittal that are not clearly noted as described herein are not valid even if the Engineer has returned the submitted marked as Approved, Approved as Noted, or Submit Specific Item.
- D. At a time decided upon at the preconstruction meeting the CONTRACTOR shall furnish the ENGINEER a Shop Drawing schedule fixing the respective dates for the initial submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall be provided as a separate entity and indicate those submittals that are critical to the progress schedule. The

CONTRACTOR shall prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities. No extension of time will be authorized because of the CONTRACTOR's failure to transmit complete and acceptable submittals sufficiently in advance of the Work.

- E. The CONTRACTOR shall not begin any work affected by a submittal returned not approved. Before starting this work all revisions must be corrected by the CONTRACTOR. After resubmittal they will be reviewed and returned to him by the ENGINEER. If approved or approved as noted, then the CONTRACTOR may begin this work. Any corrections made to the shop drawings are to be followed without exception.
- F. The CONTRACTOR shall submit to the ENGINEER all shop drawings and data sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for review from the time the ENGINEER receives them. No less than thirty (30) calendar days will be required for major equipment that requires review by more than one (1) engineering discipline.
- G. The CONTRACTOR shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to the review and approval by ENGINEER of the necessary shop drawings.
- H. All shop drawings, product data, working drawings and samples submitted by subcontractors for approval shall be sent directly to the CONTRACTOR for checking. The CONTRACTOR shall be responsible for their submission according to the approved shop drawing schedule so as to prevent delays in delivery of materials and project completion.
- I. The CONTRACTOR shall check all subcontractor's shop drawings, product data, working drawings and samples regarding measurements, size of members, materials, and details to satisfy himself that they are in conformance to the Contract Documents. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission to the ENGINEER.
- J. Requests for Information (RFI) shall be submitted on a standard form provided by the ENGINEER. RFIs shall indicate their importance to the timely completion of the project. RFIs will be processed as a shop drawing unless there is an urgent need for immediate response.

1.8 ENGINEER'S REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- A. The ENGINEER's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the CONTRACTOR from compliance with the contract plans and specifications or from departures therefrom. The CONTRACTOR remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, data, and samples will be general. They shall not be construed:
 - 1. As permitting any departure from the Contract requirements;
 - 2. As relieving the CONTRACTOR of responsibility for any errors, including details, dimensions, and materials;
 - 3. As approving departures from details furnished by the ENGINEER, except as otherwise provided herein.
- C. If the shop drawings, data or samples as submitted describe variations per subparagraph (1.6F), and show a departure from the Contract requirements which ENGINEER finds to be in the interest of the OWNER and to be so minor as not to involve a change in Contract Price or time for performance, the ENGINEER may return the reviewed drawings without noting an exception.
- D. Submittals will be returned to the CONTRACTOR under one of the following:
 - 1. "APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the CONTRACTOR may release the equipment and/or material for manufacture.
 - 2. "FURNISH AS CORRECTED" is assigned when notations or comments have been made on the submittal pointing out minor discrepancies as compared with the Contract Documents. Re-submittal is not necessary prior to release for manufacturing.
 - 3. "REVISE & RESUBMIT." This combination of codes is assigned when the submittal is in noncompliance with the Contract Documents and must be corrected and the entire package resubmitted. This code generally means that the equipment or material cannot be released for manufacture unless the CONTRACTOR takes full responsibility for providing the submitted items in accordance with Contract Documents.
 - 4. "REJECTED" is assigned when the submittal does not meet the intent of the Contract Documents. The CONTRACTOR must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.
 - 5. "SUBMIT SPECIFIC ITEM" is assigned when a specific item was left out. The CONTRACTOR must turn in a submittal on that item to bring the entire package into conformance. The entire package does not have to be resubmitted.

- E. Re-submittals will be handled in the same manner as first submittals. On resubmittals the CONTRACTOR shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the ENGINEER on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the CONTRACTOR. The CONTRACTOR shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the ENGINEER.
- F. If the CONTRACTOR considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the CONTRACTOR shall give written notice thereof to the ENGINEER at least seven (7) working days prior to release for manufacture.
- G. The ENGINEER will review a submittal a maximum of two (2) times after which cost of review will be borne by the CONTRACTOR. The cost of engineering shall be equal to the ENGINEER's charges to the OWNER under the terms of the ENGINEER's agreement with the OWNER.
- H. When the shop drawings have been completed to the satisfaction of the ENGINEER, the CONTRACTOR shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the ENGINEER.
- I. Partial submittals may not be reviewed. The ENGINEER will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the CONTRACTOR, and will be considered "Rejected" until resubmitted. The ENGINEER may at his option provide a list or mark the submittal directing the CONTRACTOR to the areas that are incomplete.

1.9 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM

- A. If specifically required in other sections of these Specifications, the CONTRACTOR shall submit a P.E. Certification for each item required, in the form attached to this Section, completely filled in and stamped.

1.10 FINAL COMBINED SUBMITTAL OF DIGITAL VERSION OF SHOP DRAWING SUBMITTALS

- A. At the completion of the project, a digital version of all shop drawing submittals and review forms in pdf format shall be compiled and provided to the ENGINEER as an appendix to the Operation and Maintenance Manual as required in Section 01730 - Operation and Maintenance Data. Should no component of the construction necessitate an Operation and Maintenance Manual, the compendium of submittals in digital form shall be submitted as a final shop drawing submittal for review by the ENGINEER.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01330

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SECTION 01380

PRECONSTRUCTION DOCUMENTATION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. The Contractor shall employ a competent photographer to take pre-construction record digital photographs and/or perform video recording, including providing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video recordings of all areas in which Work is to be performed as specified in the Contract Documents.

1.2 QUALIFICATIONS

- A. All photography shall be done by a competent digital camera operator who is fully experienced and qualified with the specified equipment.
- B. For the video recording, the audio portion should be done by a person qualified and knowledgeable in the specifics of the Contract, who shall speak with clarity and diction so as to be easily understood.

1.3 VIDEO RECORDINGS

- A. Video recording shall be accomplished for all areas that are scheduled for construction. All video recording shall be in full color. Video recording shall include full recording of both sides of all streets on which construction is to be performed.
- B. When property is adjacent to a roadway, the recording shall, when viewed, show the image, 1/4 of the roadway fronting all property and 3/4 of the image shall be of the property. The recording shall be done so as to show the roadway and property in an oblique view (30 degrees).
- C. A complete view, in sufficient detail, of all existing facilities with audio description of the exact location shall be provided.
- D. The Engineering plans shall be used as a reference for stationing in the audio portion of the recording for easy location identifications. If applicable, house numbers shall be mentioned on the audio.

- E. Two complete sets of video recording on DVD shall be delivered to the Engineer for the permanent and exclusive use of the Engineer prior to the start of any construction on the project.
- F. All DVDs shall contain the name of the project, the date and time of the video taping, the name and address of the photographer and any other identifying information required.

1.4 DIGITAL PROJECT PHOTOGRAPHS

- A. Digital cameras and photographs may be used in lieu of video recording described in Paragraph 1.3 above. Provide photographs of the entire work area prior to any construction for the purpose of recording conditions prior to construction. Photographs should be spaced at approximately 100 foot intervals along improved areas. Photographs taken along unimproved areas of the project shall be spaced at approximately 300 foot intervals. In addition, all special features shall be photographed prior to construction.
- B. The Contractor shall deliver hard copies of photographs and CD-ROM(s) or DVD(s) in conformance with the above requirements to the Engineer. No construction shall start until pre-construction photographs are completed and submitted to the Engineer.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01380

SECTION 01605

PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS

- A. Definitions: "Products" is defined to include purchased items for incorporation into the work, regardless of whether specially purchased for project or taken from Contractor's stock of previously purchased products. "Materials", is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties," "systems," "structure," finishes," "accessories," "furnishings," "special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. Substitutions: The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, or Engineer, are "changes" not "substitutions." Requested substitutions during bidding period, which have been accepted prior to Contract Date, are included in contract documents and are not subject to requirements for substitutions as specified herein. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders, except as provided in contract documents are considered requests for "substitutions," and are subject to requirements hereof.
- C. Standards: Refer to Division-1 section "Definitions and Standards" for applicability of industry standards to products of project, and for acronyms used in text of specification sections.

1.3 QUALITY ASSURANCE

- A. Source Limitations: To the greatest extent possible for each unit of work, provide products, materials or equipment of a singular generic kind and from a single source.
- B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product or material, select an option which is compatible with other products and materials already selected (which may have been from among options for those other products and materials). Total compatibility among options is not assured by limitations within contract documents, but must be provided by Contractor. Compatibility is a basic general requirement of product/material sections.

1.4 PRODUCTS LISTED

- A. Within 30 days after award of Contract, submit to Engineer six (6) copies of complete list of major products which are proposed for installation.
- B. Tabulate products by specification section number and title.
- C. For products specified only by reference standards, list for each such product:
 - 1. Name and address of manufacturer.
 - 2. Trade name.
 - 3. Model or catalogue designation.
 - 4. Manufacturer's data:
 - a. Reference standards.
 - b. Performance test data.

1.5 CONTRACTOR'S OPTIONS

- A. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
- B. For products specified by naming several products or manufacturers, select any one of those products and manufacturers named which complies with Specifications.
- C. For products specified by naming only one or more products or manufacturers and stating "or equal", select one of those named products or manufacturers. After award of the Contract, submit a request as for substitutions, for any product or manufacturer which is not specifically named.
- D. For products specified by naming only one product and manufacturer, there is no option and no substitution will be allowed.

1.6 SUBSTITUTION SUBMITTALS

- A. Requests for Substitutions: Submit three (3) copies, fully identified for product or method being replaced by substitutions, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Include product data/drawings, description of methods, samples where applicable, Contractor's detailed comparison of significant qualities between specified item and proposed substitutions, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitution will result in overall work equal-to-or better- than work originally indicated.
- B. Within a period of 30 days after award of Contract, Engineer will consider formal requests from the Contractor for substitution of products in place of those specified:
 - 1. After the end of that period, the request will be considered only in case of product unavailability or other conditions beyond the control of the Contract Documents:
- C. Submit a separate request for each substitution. Support each request with:
 - 1. Complete data substantiating compliance of the proposed substitution. Support each request with:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature; identify:
 - 1) Product description.
 - 2) Reference standards.
 - 3) Performance and test data.
 - c. Samples, as applicable.
 - d. Name and address of similar projects on which product has been used, and the date of each installation.
 - 2. Itemized comparison of the proposed substitution with product specified; list significant variations.
 - 3. Data relating to changes in the construction schedule.
 - 4. Any effect of the substitution on separate contracts.
 - 5. List of changes required in other work or products.
 - 6. Accurate cost data comparing proposed substitution with product specified.
 - 7. Designation of required license fees or royalties.
 - 8. Designation of availability of maintenance services and sources of replacement materials.
- D. Substitutions will not be considered for acceptance when:
 - 1. They are indicated or implied on Shop Drawings or product data submittals without a formal request from Contractor.
 - 2. They are requested by anyone other than Contractor.
 - 3. Submitted without data relating to changes in construction schedule.
 - 4. Any effect of substitution on separate contracts is not included.
 - 5. A list of changes required in other work or products is not included.

6. Accurate cost data comparing proposed substitution with product specified is not included.
 7. Designation of required license fees or royalties is not included.
 8. Designation of availability of maintenance services, sources of replacement materials is not included.
 9. Acceptance will require substantial revision of Contract Documents.
- E. Substitute products shall not be ordered or installed without written acceptance of Engineer.
- F. Engineer will determine the acceptability of proposed substitutions. Contractor shall pay all costs associated with Engineer's review.

1.7 CONTRACTOR'S REPRESENTATION

- A. In making formal request for substitution, the Contractor represents that:
1. The proposed product has been investigated and determined that it is equal to or superior in all respects to that specified.
 2. The same warranties or bonds shall be provided for substitution as for product specified.
 3. The installation of accepted changes shall be incorporated as may be required for the Work to be complete in all respects.
 4. Any claims for additional costs caused by substitution are waived.
 5. All costs, resulting under separate contracts, which result from the substitution, are the responsibility of the Contractor.
 6. Any and all Engineering costs for redesign or revision of the Contract Documents shall be the responsibility of the Contractor.
 7. Cost data is complete and includes related costs under his contract, but not:
 - a. Costs under separate contracts.
 - b. Engineer's costs of redesign or revision of Contract Documents.

1.8 ENGINEER DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

1.9 PRODUCT DELIVERY-STORAGE-HANDLING

- A. General: Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Control delivery schedules to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for

products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

1.10 WARRANTIES (GUARANTEES)

- A. Coincidental Product Warranty: A warranty which is not specifically required by contract documents (other than as specified in this section) but which is available on a product incorporated into the work, by virtue of the fact that manufacturer of product has published warranty in connection with purchases and uses of product without regard for specific applications except as otherwise limited by terms of warranty.
- B. Refer to individual sections of Division 2 through 16 for the determination of units of work which are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).
- C. General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated, specific warranties do not cover failures in the work which results from:
 - 1. Unusual and abnormal phenomena of the elements.
 - 2. The Owner's misuse, maltreatment or improper maintenance of the work.
 - 3. Vandalism after time of substantial completion.
 - 4. Insurrection of acts of aggression including war.
- D. Related Damages and Losses: In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.
- E. Reinstatement of Warranty Period: Except as otherwise indicated, when product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement for the following time period, starting on date of acceptance of replaced or restored work.
- F. A period of time equal to original warranty period of time.
- G. Replacement Cost, Obligations: Except as otherwise indicated, costs of replacing or restoring failing warranted units or products is Contractor's obligation, without regard for whether Owner has already benefited from use through a portion of anticipated useful service lives.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCES

- A. General: The compliance requirements, for individual products as indicated in contract documents, are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliances with codes, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with. Also "allowances" and similar provisions of contract documents will have a bearing on selection process.
- B. Procedures for Selecting Products: Contractor's options for selecting products are limited by contract document requirements, and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction project. Required procedures include, but are not necessarily limited to, the following for various indicated methods of specifying:
 - 1. Single Product/Manufacturer Name: Provide product indicated, except advise Engineer before proceeding, where known that named product is not a feasible or acceptable selection.
 - 2. Two or More Product/Manufacturer Names: Provide one of the named products, at Contractor's option, but excluding products which do not comply with requirements. Do not provide or offer to provide an unnamed product, except where none of named products comply with requirements or are a feasible selection; advise Engineer before proceeding.
 - 3. "Or Equal": Where named products in specifications text are accompanied by the term "or equal," or other language of similar effect, comply with those contract document provisions concerning "substitutions" for obtaining Engineer's approval (by change order) to provide an unnamed product.
 - 4. "Approved Equal": The use of this phrase shall mean that in lieu of the product called for in the Specifications, the Contractor may submit to the Engineer another product for consideration. The Engineer must receive a package that details the product for consideration at least two (2) weeks (14 days) prior to the receipt of Bids. Only the Contractor wishing to use another product may submit that product for review. If approval is given, the Engineer will notify the Contractor in writing. Any modifications necessary, including piping, electrical, structural, etc. that may be required, will be the responsibility of the Contractor.
 - 5. "Named," except as otherwise indicated, is defined to mean manufacturer's name for product, as recorded in published product literature, of latest issue as of date of contract documents. Refer to requests to use products of a later (or earlier) model to Engineer for acceptance before proceeding.
 - 6. Standards, Codes and Regulations: Where only compliance with an imposed standard, code or regulation is required, selection from among products which comply with requirements including those standards, codes and regulations, is Contractor's option.

7. Performance Requirements: Provide products which comply with specific performances indicated, and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated. Overall performance of a product is implied where product is specified with only certain specific performance requirements.
8. Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements, using specified ingredients and components, and complying with specified requirements for mixing, fabricating, curing, finishing, testing and similar operations in manufacturing process.

2.2 SUBSTITUTIONS

- A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to contract documents are not required and changes are in keeping with general intent of contract documents; when timely, fully documented and properly submitted; and when one or more of the following conditions is satisfied, all as judged by Engineer. Otherwise, request will be returned without action except to record noncompliance with these requirements:
 1. Where request is directly related to an "or equal" clause or other language of same effect in contract documents. Where "or approved equal" is not specified, no other material or article may be substituted.
 2. Where required product, material or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the work promptly to coordinate various activities properly.
 3. Where required product, material or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated, therewith, or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial non-compliances which are not possible to otherwise overcome except by making requested substitution, which Contractor thereby certifies to overcome such non-compatibility, non-coordination, nonwarranty, non-insurability or other non-compliance as claimed.
 4. Where required product, material or method cannot receive required approval by a governing authority, and requested substitution can be so approved.
 5. Where substantial advantage is offered Owner, in terms of cost, time, energy conservation or other valuable considerations, after deducting offsetting responsibilities, Owner may be required to bear, including additional compensation to Engineer for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.
- B. Work-Related Submittals: Contractor's submittal of, and Engineer's acceptance of shop drawings, product data or samples which indicated work not complying with requirements of contract documents, does not constitute an acceptable and valid request for, nor approval of, a substitution.

2.3 GENERAL PRODUCT REQUIREMENTS

- A. General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for intended use and effect.
- B. Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar applications.
- C. Continued Availability: Where additional amounts of a product, by nature of its application, are likely to be needed by Owner at a later date for maintenance and repair or replacement work, provide a standard, domestically produced product which is likely to be available to Owner at such later date.
- D. Equipment Nameplates: Provide permanent nameplate on each item of service connected or power operated equipment. Indicate manufacturer, product name, model number, serial number, capacity, speed, ratings and similar essential operating data.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01605

SECTION 01625

STARTUP

PART 1 - GENERAL

1.1 GENERAL

- A. Prior to requesting issuance of the certificate of substantial completion, start-up will be completed as specified herein.
- B. Start-up of the project facilities and appurtenances will require cooperation between completion of remaining structures and connection to existing system.
- C. All equipment shall be tested by the Contractor and approved by the Owner and/or Engineer prior to placing the facilities into operation.
- D. All lubricants, fuel and power necessary for initial operation and tests shall be furnished by the Contractor.
- E. In addition to furnishing, delivering, installing, and testing equipment, the Contractor shall provide the services of competent manufacturing representatives for the periods indicated in other sections of these Specifications. Such representative shall assist the Owner's personnel in start-up by instructing the operating personnel of the Owner in the maintenance and operation of the equipment, conducting tests, and making recommendations for producing the most efficient results. These services shall be made during the initial operation of the completed facilities and be over and above any services necessary during erection or to correct defective materials or workmanship during the guarantee period. These representatives shall be specially trained and qualified for installation, adjustment, start-up, and testing work and shall not be sales representatives only. The cost of such representation, including subsistence and travel, shall be included under this contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRELIMINARY MATTERS

- A. General Requirements:
 - 1. Successfully execute the step-by-step procedure of start-up and performance demonstration specified hereinafter.

2. The start-up and performance demonstration shall be successfully executed prior to substantial completion and acceptance by the Owner.
3. Field acceptance tests shall be witnessed by the Owner and Engineer. At least 30 calendar days prior to scheduled testing, Contractor shall submit details of all test procedures to the Engineer for review.
4. All performance tests and inspections shall be scheduled at least 10 working days in advance or as otherwise specified with the Owner and Engineer. All performance tests and inspections shall be conducted during the normal work week of Monday through Friday, unless otherwise specified.
5. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner takes over the operation thereof.

B. Preparation for Start-Up:

1. Upon completion of the project and all its related systems, all process systems and pipe lines shall be filled and flushed with water and hydraulically checked for leaks, cracks, and defects.
2. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected.
3. All instruments and controls shall be calibrated through their full range. Any other adjustments required for proper operation of all instrumentation and control equipment shall be made.
4. The Contractor shall perform all other tasks needed for preparing and conditioning the treatment facility for proper operation.
5. No testing or equipment operation shall take place until it has been verified by the Engineer that all specified safety equipment has been installed and is in good working order.
6. No testing or equipment operation shall take place until it has been verified by the Engineer that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance data manuals have been furnished as specified.

- C. Submit start-up plans to the Engineer indicating start-up preparation for electrical systems, instrumentation systems, valves and equipment components, and the initial mode of operation for each system.

3.2 FIELD TESTS

- A. Field tests shall be made to confirm compliance with the Contract and to establish compliance with the technical provision. The test shall be performed by the Contractor as herein specified. All water lines, piping, and equipment shall be tested in the field in the presence of the Engineer or his authorized assistant, in the manner prescribed in the Sections of these Specifications pertaining to such installation.

- B. Hydrostatic and Leakage Tests - Potable Water Lines; Plant Water Lines:
 - 1. All water lines installed under this contract shall be tested in accordance with detailed procedures outlined in Division 2.
 - 2. The Contractor shall give the Engineer 48 hours advance notice of the time when the installation is ready for hydrostatic and leakage tests.
 - 3. Engineer and/or a representative of the Owner may be present during all tests. No additional compensation will be paid to the Contractor for making the above tests; the cost of all labor, materials, lubricants, fuels, power, necessary appliances, and the coordination for testing purposes shall be included prices bid for the various items of work.
- C. Disinfection of Potable Water Lines and Plant Water Lines
 - 1. All water lines installed under this contract shall be disinfected by chlorination. Detailed procedures are outlined in Division 2.
 - 2. The Contractor shall give the Engineer 48 hours advance notice of the time when the installation is ready for hydrostatic and leakage tests.
 - 3. Engineer and/or a representative of the Owner may be present during all tests. No additional compensation will be paid to the Contractor for disinfection; the cost of all labor, materials, power, and coordination for disinfection shall be included in prices bid for the various items of work.

3.3 INITIAL OPERATION TESTS

- A. Upon completion of all structural, installation and adjustment of equipment, and pipe work, in a manner satisfactory to the Engineer, the Contractor shall designate a way for initial testing of the facilities. Prior to such completion date, the Contractor shall give the Owner ten (10) days notice thereof in writing and the Owner will then appoint the personnel who will operate the equipment, and on the test day designated, the Contractor shall make the initial test to determine performance using the personnel designated by the Owner and such other personnel of his own as is specified or as he deems necessary to complete the tests. The field tests required will be as described in the applicable Sections of these Specifications and modified as required to test the installed equipment by the Owner/Engineer.
- B. In the event the initial or final guarantee testing and demonstration of equipment and controls does not meet the guarantee conditions or is not demonstrated to the satisfaction of the Engineer, the Contractor shall, at his own expense, make such changes and adjustments in the equipment which is deemed necessary and shall conduct further tests until full satisfaction is received thereof.
- C. The Owner will pay the salaries of the personnel selected by the Owner for operation of the equipment. Payment of all other salaries, public utility services, and operating expenses shall be borne by the Contractor for the test period and any additional test period required.

- D. All performance tests and inspections shall be conducted during the normal work week of Monday through Friday, unless otherwise specified.

END OF SECTION 01625

SECTION 01770
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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. Related Sections include the following:
 - 1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
 - 2. Division 1 Section "Pre-Construction Documentation" for submitting Final Completion construction photographs and negatives.
 - 3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 3. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

5. Complete startup testing of systems.
6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
7. Complete final cleaning requirements, including touchup painting.
8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- B. Inspection: Submit a written request for inspection for Substantial Completion. 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. Reinspection: 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.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
 2. Submit copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies 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. 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.

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

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: Provide 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 in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before inspection for certification of Substantial Completion for entire Project or for a 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 neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. 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.
 - f. Remove labels that are not permanent.
 - g. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - h. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - i. Replace parts subject to unusual operating conditions.
 - j. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
 - 2. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit two (2) set(s) of marked-up Record Prints. Engineer will review and provide comments.
 - b. Final Submittal: Submit five (5) set(s) of marked-up Record Prints.
- B. Record Product Data: Submit one (1) copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 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 prepare the 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 understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 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. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Locations of concealed internal utilities.
 - h. Changes made by Change Order or Construction Change Directive.
 - i. Changes made following Engineer's written orders.
 - j. Details not on the original Contract Drawings.
 - k. Field records for variable and concealed conditions.
 - l. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - 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 and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Identification: As follows:

- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Engineer.
- e. Name of Contractor.

2.2 RECORD PRODUCT DATA

- A. 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.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples 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.

END OF SECTION 01781

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SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This Section covers clearing, grubbing and stripping along the construction sites, complete as specified herein.
- B. The CONTRACTOR shall clear and grub all of the area within the limits of construction or as required. The area to be cleared shall be reviewed by the ENGINEER prior to the beginning of any clearing.
- C. All trees noted as to be removed shall first be root pruned prior to removal. All such trees shall be relocated as determined by the OWNER. All trees noted to be retained shall be protected from damage during construction.

1.2 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. Division 02 Section "Earthwork" for excavation, backfilling, filling, compaction and structure and road base preparation.
- C. Division 02 Section "Sedimentation and Erosion Control" for temporary erosion and sedimentation control measures.
- D. Division 02 Section "Trench Excavation, Backfill, and Compaction" for excavating and backfilling buried mechanical utilities and buried utility structures.
- E. Division 16 Section for excavating and backfilling buried electrical utilities and buried utility structures.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLEARING

- A. The surface of the ground, for the area to be cleared and grubbed, shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on, or protruding through, the surface of the ground. However, those trees which are designated by the ENGINEER shall be preserved as hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. Clearing for structures shall consist of topsoil and vegetation removal.

3.2 GRUBBING

- A. Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for, or by the removal of, such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.3 STRIPPING

- A. In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the CONTRACTOR.

3.4 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

- A. Dispose of all material and debris from the clearing, grubbing, and stripping operation off site in accordance with all federal, state, county, and city laws, codes and ordinances. Burying of debris on site will not be allowed. The cost of disposal (including hauling) of the cleared, grubbed, and stripped material and debris shall be considered a subsidiary obligation of the CONTRACTOR, the cost of which shall be included in the Contract prices.

3.5 PRESERVATION OF TREES

- A. Those trees which are designated by the ENGINEER for preservation shall be carefully protected from damage. Erect such barricades, guards, and enclosures as may be considered necessary by him for the protection of the trees during all construction operations.

3.6 EXCAVATED MATERIALS UNSUITABLE FOR CONVENTIONAL DISPOSAL

- A. It will be the CONTRACTOR'S responsibility to properly dispose of materials unsuitable for conventional disposal.

END OF SECTION 02100

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 - 2. Subbase course for concrete pavements.
 - 3. Excavating and backfilling trenches within building lines.
 - 4. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. CONTRACTOR shall be responsible for the balance of earthwork on the site.

1.2 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. Division 02 Section "Site Preparation" for site clearing, grubbing, stripping and stockpiling topsoil, protecting trees to remain, and removal of above- and below-grade improvements and utilities.
- C. Division 02 Section "Sedimentation and Erosion Control" for temporary erosion and sedimentation control measures.
- D. Division 02 Section "Trench Excavation, Backfill, and Compaction" for excavating and backfilling buried mechanical utilities and buried utility structures.
- E. Division 16 Section for excavating and backfilling buried electrical utilities and buried utility structures.
- F. The Appendix of this document includes the geotechnical report for the project entitled "Geotechnical Exploration Dade City Elevated Water Tank and Well Project", dated June 29, 2018, prepared by Universal Engineering Sciences. The Contractor is responsible for reviewing the report and performing all work in accordance with the recommendations included in the report.

1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Ditch/Swale Grading: Consists of the excavation and satisfactory disposal of all materials from the limits of ditch/swale as shown on the plans.
- F. Excavation: Removal of material encountered above subgrade elevations of all types of materials encountered in areas as designated on the construction plans or specified in the technical specifications; and the placement of the excavation material, wherever practicable, in embankments.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by ENGINEER. Except in areas identified in the drawings for over excavation or in areas required for subgrade compaction by other sections of the specifications, additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by ENGINEER. Unauthorized excavation, as well as remedial work directed by ENGINEER, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- J. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Test Reports: In addition to test reports required under field quality control, submit the following:
 - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
 - 2. One optimum moisture-maximum Modified Proctor Density Curve for each soil material.
 - 3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.5 QUALITY ASSURANCE

- A. Testing and Inspection Service: Employ, at Contractor's expense, and coordinated by the Contractor, a qualified independent geotechnical engineering testing agency, under the direction of a Professional Engineer, licensed in the State of Florida, to classify, perform soil tests, and provide inspection services for quality control during earthwork operations. All proposed fill soils will require the testing agency to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor shall replace materials removed for testing purposes. Should any work or materials fail to meet the requirements set forth in the plans and specifications, Contractor shall pay for re-testing of same.
- B. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to the Engineers' satisfaction, based on evaluation of laboratory-submitted criteria, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the work.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities unless permitted in writing by ENGINEER and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner or Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's and Engineer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner, and utility companies in keeping respective services and facilities in operation.

Contractor shall bear all costs of repairing damaged utilities to the satisfaction of utility owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 1.5 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. 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.
- F. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- G. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 02 Section "Site Preparation."

- C. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- D. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- E. Tree Protection is specified in the Division 02 Section "Site Preparation".

3.2 EXPLOSIVES

- A. Explosives: The use of explosives is not permitted.

3.3 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
- C. The Contractor shall prevent the accumulation of water in excavated areas, and shall remove by pumping or other means any water which accumulates in the excavation. The Contractor shall prevent the accumulation of water in both structural and trench excavations and shall remove by well point system or by other means water which accumulates. The Contractor shall provide, install and operate a suitable and satisfactory dewatering system. The Contractor shall include the cost of this pumping equipment and work in the lump sum price bid for the work.
- D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collection or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials. Waste unsatisfactory material as specified.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

- a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- B. Cut: Where required, the site shall be excavated to the grades shown. Excavated material that is suitable shall be used in the fill sections of the site.
- C. Fill: In order to ensure proper bond and prevent slipping between the original ground and fill, the surface of the original ground shall be scarified to a depth of at least three inches. Each layer of fill material shall be compacted until the required density is achieved.

3.5 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.
- B. All excavation work shall conform to OSHA Publication "Excavations 2226," 1990 revision, and OSHA Excavation; Final Rule 29, CFR, Part 1926, October 31, 1989, or other applicable excavation safety standards. The Contractor will provide written assurance of compliance with the law and with the laws of Florida Chapter 90-96. The Contractor's method of providing protective support to prevent cave-ins shall be submitted with the bid and conform to OSHA requirements. Slope excavations, shoring, and trench box usage in the field must be based on tabulated data and designed by the Contractor.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATIONS FOR TANK FOUNDATIONS/STRUCTURAL SLABS

- A. Excavate 36" below bearing subgrade elevation, compact 18" below, backfill with engineered fill and compact to 98% modified proctor.

3.8 EXCAVATION FOR UTILITY TRENCHES

- A. Refer to Section 02221.

3.9 APPROVAL OF SUBGRADE

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation by placing compacted backfill of satisfactory material as indicated for fill material placement in the location of excavation.

3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials to be used as fill. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover short-term storage piles to prevent windblown dust. For stockpiles with portions to remain longer than four weeks, provide a temporary vegetative cover by hydroseeding within two weeks of final soil placement of any areas remaining static. Cover remaining areas.
- B. Stockpile soil materials away from edge of excavations.
- C. Do not store within drip line of remaining trees.

3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.

3. Removing concrete formwork.
4. Removing trash and debris.
5. Removing temporary shoring and bracing, and sheeting.
6. Installing permanent or temporary horizontal bracing on horizontally supported walls.

- B. Place backfill on subgrades free of mud, frost, snow, or ice. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, backfill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

3.13 UTILITY TRENCH BACKFILL

- A. Backfill trenches to indicated grades, and elevations. Refer to Section 02221.

3.14 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.

3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 1. Do not place backfill or fill 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.

3.16 COMPACTION OF BACKFILLS AND FILLS

- A. Structure footprints including all building pads, tankage, parking areas and roadway areas are to be proof rolled and compacted with traffic sized non-vibratory equipment. Using vibratory compaction equipment on this site may disturb adjacent structures. Contractor shall monitor nearby structures before and during proof-compaction. If disturbance is noted, halt vibratory compaction and notify the Engineer and Owner immediately.
- B. Water should be added at the start of compaction efforts if the soils are dry, and excess water should be allowed time to percolate through existing soils.
- C. Compaction shall include a minimum of 8 passes in structure areas with each pass overlapping the previous pass by a minimum of 2' with the rolling extended to the greater of 10' beyond the structure area or the remaining fill height to subgrade.
- D. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- E. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- F. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
 - 1. Under structures, building slabs and roadways, scarify and recompact top 18 inches of existing subgrade and each layer of backfill or fill material at 98 percent.
 - 2. Under tankage, scarify and recompact top 36 inches of existing subgrade and each layer of backfill or fill material at 98 percent.
 - 3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
 - 4. Under lawn areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.
 - 5. The top 12 inches of soil beneath structural slabs-on-grade and beneath footings should be compacted to a minimum of 98 percent Modified Proctor Density.

3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building/Tankage Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 FIELD QUALITY CONTROL

- A. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- B. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by ENGINEER.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Tankage and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2000 sq. ft. or less of building slab, but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one (1) test for each 100 feet or less of wall length, but no fewer than two (2) tests.
 - 3. Trench Backfill: For each 150 feet or less of trench length, but no fewer than two tests per length. A field density test shall be performed at the following locations in the trench backfill:
 - a. Bottom lift
 - b. Center of pipe
 - c. 12" over pipe
 - d. Every second (12") lift to subgrade elevation.
- D. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer
- E. If, in the opinion of the Engineer, based on testing service reports and inspection, when subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

- F. Perform additional spot testing as directed by the ENGINEER as incidental to the required testing. Spot testing shall not exceed in number ten percent of the otherwise required testing except that spot test which fail the specification shall not count towards this limit.

3.19 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.
 - 1. Scarify or remove and replace soil material to depth as directed by ENGINEER; reshape and recompact at optimum moisture content to the required density.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.
- D. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout in the manner prescribed in Division 02 specification sections.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Spread soil and compact as a "lawn" area with grading as indicated by the Drawings or as directed by Engineer.
- B. Remove waste material, including trash, and debris, and legally dispose of it off Owner's property.
- C. Dispose of unsatisfactory soil, and oversized rock separately from suitable soil at locations within the Owner's property as indicated by the Engineer.

END OF SECTION 02200

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SECTION 02221

TRENCH EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK

- A. Excavation, shoring, dewatering, pipe bedding, trench backfill, compaction, grading and cleanup of all pipeline trenching for the project.
- B. All work must be done in accordance with these specifications and the safety requirements of the State and OSHA standards.

1.2 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. Division 02 Section "Earthwork" for excavation, backfilling, filling, compaction and structure and road base preparation.
- C. Division 02 Section "Site Preparation" for site stripping, grubbing, stripping and stockpiling topsoil, protecting trees to remain, and removal of above- and below-grade improvements and utilities.
- D. Division 02 Section "Sedimentation and Erosion Control" for temporary erosion and sedimentation control measures.
- E. Division 16 Section for excavating and backfilling buried electrical utilities and buried utility structures.
- F. The Appendix of this document includes the geotechnical report for the project entitled "Geotechnical Exploration Dade City Elevated Water Tank and Well Project", dated June 29, 2018, prepared by Universal Engineering Sciences. The Contractor is responsible for reviewing the report and performing all work in accordance with the recommendations included in the report.

1.3 JOB CONDITIONS

- A. Accept site in condition existing during Contract time frame.

- B. Groundwater/surface water found during construction are conditions of the Contract and responsibility of CONTRACTOR.

PART 2 - PRODUCTS

2.1 PIPE BEDDING AND BACKFILL

- A. Determination of source of materials for bedding and backfill shall be responsibility of CONTRACTOR, but use of such materials shall be subject to approval of ENGINEER.
- B. Pipe bedding shall be angular material.

2.2 SAND BACKFILL

- A. Where specified on plans, use sand or fine aggregate with source of material subject to approval of the ENGINEER.

2.3 CRADLING ROCK

- A. Use crushed rock or stone with 70-100% passing 1" sieve and no more than 50% passing 3/4" sieve. Crushed oyster shells are acceptable.

2.4 CONTROLLED DENSITY FILL

- A. Use high slump mixture of Portland cement, fly ash and fine aggregate in accordance with Section 121 of the latest edition of the FDOT Standard Specifications for Road and Bridge Construction for excavatable or non-excavatable fill, as required.
- B. Provide mixture with minimum 28-day compressive strength of 70 psi (excavatable) or 125 psi (non-excavatable) with no measurable shrinkage or surface settlement.

2.5 SHEETING, SHORING AND BRACING

- A. Use sound timber or structural steel.
- B. Use shapes and sizes as required.
- C. Designed by a licensed Professional Engineer for the project area for live and dead loads and groundwater conditions

PART 3 - EXECUTION

3.1 GENERAL

A. Dewatering

1. Prevent surface water from flowing into excavation.
2. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering.
3. No sanitary sewer shall be used for disposal of trench water.
4. Soil erosion and sediment control and stormwater pollution prevention plan devices to be installed and maintained throughout dewatering operation

B. Protection of Existing Utilities

1. Notify all utilities of location and schedule of work.
2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility and ENGINEER of conflicts between existing and proposed facilities.
3. Repair, relay or replace existing utilities damaged, destroyed or disrupted during work. Unless specified otherwise, replacement will be at the CONTRACTOR's expense.

C. Sheet piling, Shoring and Bracing

1. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.
2. Leave sheet piling and shoring in place where removal might cause damage to work or as otherwise indicated on drawings.
3. When moveable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade

1. Minor adjustments to grades may be made from plan grades to suit unforeseen construction conflicts or conditions with approval from ENGINEER.
2. No additional compensation will be made for such minor changes.

3.2 EXCAVATION AND TRENCHING

A. General

1. Method of excavation at CONTRACTOR's option.
2. The CONTRACTOR will use caution when excavating under tree roots and under and around structures and utilities. Excavate by hand when necessary.
3. Stockpile and replace topsoil equal to pre-existing depth for surface restoration in grassed or agricultural areas where specified or shown on plans.

B. Trench Characteristics

1. Depth: As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated. Where depth is not indicated, place pipe at such depth to provided required minimum cover and slope from connection points and provide minimum clearances at all utility crossings.
2. Width
 - a. Keep width of trench as narrow as possible and yet provide adequate room for backfilling and jointing.
 - b. Maximum trench width of 30-inch or pipe O.D. plus 18 inches where soil conditions permit.
3. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.
4. Trench bottom shall be free of large stones and other foreign material.

3.3 ORGANIC OR UNSTABLE MATERIALS

- A. Stop work and notify ENGINEER.
- B. Perform remedial work as directed.
- C. If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by the ENGINEER.

3.4 ROCK EXCAVATION

- A. Excavate any rock to maintain minimum 6-inch clearance around pipe.
- B. Dispose of rock material not suitable for backfill as directed by the ENGINEER.
- C. Use of explosives not permitted without prior written authorization from the OWNER and ENGINEER.
- D. Provide Special Hazard Insurance covering liability for blasting operations.

3.5 BEDDING

- A. Place after bottom of trench has been excavated to proper depth and grade.
- B. Place, compact and shape bedding material to conform to barrel of pipe to ensure continuous firm bedding for full length of pipe. Bedding soils should be compacted to a minimum soil density of 95% of the Modified Proctor test (ASTM D1557).
- C. Provide bedding, as described below, unless indicated otherwise on Plans or in Special Conditions.
 1. Ductile Iron Pipe: ANSI/AWWA C600 Type 2 and above according to bury depth as noted in the Ductile Iron Pipe Design Manual 2.04 or latest revision.

2. Flexible Pipe Soil Class III Uni-bell “Handbook of PVC Pipe” Tables 10.9 and 10.10
3. See standard plan details.

3.6 TRENCH BACKFILL

- A. Use excavated material backfill unless otherwise specified or directed.
- B. Use suitable backfill for all trenches within 5 feet of buildings and beneath walks, parking areas, paved streets or existing exposed utilities.
- C. Initial Backfill
 1. Place after pipe has been bedded and checked for alignment, grade and internal obstructions.
 2. Carry out in an orderly fashion after authorization to cover pipe has been given.
 3. Allow no more than 300 feet of trench to be open at one time.
 4. Do not backfill until concrete or mortar has sufficiently cured.
 5. Record location of connections and appurtenances before backfilling.
 6. Place by hand and hand tamp under, around and over pipe joints and fittings, to not less than 12 inches above top of pipe, in approximately 4-inch layers.
 7. Backfill simultaneously on both sides of pipe to prevent displacement.
 8. Place cushion of 4 feet above pipe envelope before using heavy compacting equipment.
- D. Subsequent Backfill
 1. Place backfill into trench at an angle so that impact on installed pipe is minimized.
 2. Compaction of all backfill material shall be performed in a manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
 3. Area under pavement and walks or within buildings shall be mechanically compacted to the top of the subgrade in 6-inch lifts to a minimum of 95 percent Modified Proctor Density.
 4. Area under tankage shall be mechanically compacted to the top of the subgrade in 6-inch lifts to a minimum of 98 percent Modified Proctor Density
 5. Areas not subject to vehicular traffic shall be backfilled and compacted in layers not more than 12 inches in depth to a minimum soil density of 92% of the Modified Proctor test (ASTM D1557).
 6. Compaction method at discretion of the CONTRACTOR with the following exceptions:
 - a. If in the ENGINEER's opinion compaction method presents potential damage to pipe, it will not be allowed.
 - b. Compaction of any backfill material by flooding or jetting will require prior written authorization of the ENGINEER.
 7. Mound excavated materials no greater than 6 inches in open areas only.
 8. Fill upper portion of trench with topsoil as specified hereinbefore.

9. No trench shall be open overnight.

E. Controlled Density Fill

1. Use where shown on plans.
2. Provide suitable forms to limit volume of controlled density fill material.
3. Protect exposed utility lines during placement.
4. Place material in accordance with suppliers' written recommendations unless directed otherwise by the ENGINEER.

3.7 FORCE MAIN, RECLAIMED WATER FORCE MAIN, POTABLE WATER MAIN, AND GRAVITY SEWER MARKING TAPE

- A. All polyvinyl chloride (PVC) and ductile iron (DI) pipelines 4-inches and greater shall have identification marking tape.
- B. A polyethylene double-safe detectable marking tape shall be installed continuously in the backfill along the entire length of all gravity sewer, sewage force mains, potable water, reclaimed water or any other yard piping for identification and detection purposes.
- C. All ductile iron pipelines marking tape shall be non-detectable type, but shall have all of the design features as specified herein. As directed by the OWNER, buried ductile iron pipe for unforeseen conflicts shall be encased in a colored tubular polywrap conforming to 100% polyethylene material in accordance with ASTM D1248-84 Type 1, Class C, grade E-1, tensile strength 1200 psi, elongation 300%.
- D. The tape shall be as manufactured by Thor Enterprises or equal. The polyethylene tape shall meet the requirements of ASTM D 1248, Type I Class A, Grade E-1 for polyethylene plastics molding and extrusion materials. The tape shall have a minimum tensile strength of 1750 psi, a minimum elongation of 250 percent, not less than 50 gauge solid aluminum core and a nominal thickness of 5 mils. The tape shall be composed of 2 mil clear film reverse - printed laminated to aluminum, foil-laminated to 2 mil clear film and reverse-printed. Minimum total thickness 4 mils.
- E. The tape for sewage force mains, gravity sewer pipes and plant process piping shall have a fade-resistant green color throughout conforming to the American Public Works Association and Utility Location Coordination Council Color coding. The continuous warning message shall be repeated every 16 to 36 inches in lettering no less than 2 inches high.
- F. Marking Tape Message:
 1. The message for PVC or DI sewage force mains and plant process piping shall be printed on one side in black letters (typical for all lettering) and shall read "CAUTION: BURIED SEWER FORCE MAIN BELOW".
 2. The message for PVC or DI gravity sanitary sewer pipe including service connections installed in areas of earthen cover only, shall be fade-resistant green

color and shall read "CAUTION: BURIED GRAVITY SANITARY SEWER LINE BELOW".

3. The message for PVC or DI potable water pipe including service connections shall be fade-resistant blue color and shall read "CAUTION: BURIED RECLAIMED WATER LINE BELOW".

G. Minimum marking tape widths shall be as follows:

Pipe Inside Diameter, Inches	Minimum Tape Width, Inches	No. of Tape strips
4 through 12	4	1
14-20	4	2

- H. The CONTRACTOR shall submit typical samples of the printed marking tape to the ENGINEER for approval prior to installation (minimum length to show repeat of message).
- I. The marking tape shall be placed in the trench backfill directly above and centered over the pipeline. The marking tape shall be installed between 12 and 18 inches above the top of the pipe. The CONTRACTOR shall exercise care to prevent damage to the polyethylene tape when placing the remaining backfill.
- J. Where the pipeline passes through in a manhole, vault or other underground structure, the polyethylene marking tape shall be placed on top of that portion of the pipeline, located inside the structure and shall be secured to the pipeline with adhesive tape.
- K. Openings for air valves and similar appurtenances shall be provided by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the polyethylene is installed over the appurtenance, the slack shall be taped securely to appurtenance and the cut in the polyethylene shall be repaired with adhesive tape.
- L. The CONTRACTOR shall deliver to the OWNER 100 feet of the polyethylene marking tape of each color and each width size after construction is completed.

3.8 EXCESS MATERIAL

- A. Dispose of waste excess excavated material as directed by the ENGINEER.

3.9 TESTING

- A. Payment of failed tests will be the responsibility of the CONTRACTOR.

- B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Trench Backfill: For each 150 feet or less of trench length, but no fewer than two tests per length. A field density test shall be performed at the following locations in the trench backfill:
 - a. Bottom lift
 - b. Center of pipe
 - c. 12" over pipe
 - d. Every second (12") lift to subgrade elevation.
- C. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.
- D. If, in the opinion of the Engineer, based on testing service reports and inspection, when subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.
- E. Perform additional spot testing as directed by the ENGINEER as incidental to the required testing. Spot testing shall not exceed in number ten percent of the otherwise required testing except that spot test which fail the specification shall not count towards this limit.

END OF SECTION 02221

SECTION 02270

SEDIMENTATION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all installation, maintenance, removal, and area cleanup related to sedimentation control work as shown on the Drawings and as specified herein or as required to prevent the transport of silt or sediment outside the limits of construction. The work shall include, but not necessarily be limited to, installation of temporary access ways and staging areas, silt fences, temporary seeding, turbidity barriers, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, and final cleanup.
- B. The CONTRACTOR shall prepare a Sedimentation and Erosion Control Plan. This plan shall be used as a minimum in developing the Pollution Prevention Plan for the NPDES permit application (notification) to be filed by the CONTRACTOR.

1.2 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. Division 02 Section "Site Preparation" for site stripping, grubbing, stripping and stockpiling topsoil, protecting trees to remain, and removal of above- and below-grade improvements and utilities.
- C. Division 02 Section "Earthwork" for excavation, backfilling, filling, compaction and structure and road base preparation.
- D. Division 02 Section "Trench Excavation, Backfill, and Compaction" for excavating and backfilling buried mechanical utilities and buried utility structures.
- E. Division 16 Section for excavating and backfilling buried electrical utilities and buried utility structures.

1.3 SUBMITTALS

- A. Within 14 days after receipt of notice to proceed, the CONTRACTOR shall submit to the ENGINEER for approval, technical product literature for all commercial products to be used for sedimentation and erosion control.

1.4 QUALITY ASSURANCE

- A. The CONTRACTOR shall be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off-site areas, via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment outside the limits of construction shall be installed, maintained, removed, and cleaned up at the expense of the CONTRACTOR. No additional charges to the OWNER will be considered.
- B. Sedimentation and erosion control measures shall conform to the Best Management Practices outlined in the Drawings and in the Florida Development Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Silt Fence
 1. Silt fence shall include all components as indicated in the drawings.
 2. All lumber used in the silt fencing shall be pressure/preservative treated.
 3. Unless indicated otherwise, prefabricated silt fences with hay bales are permitted as long as they meet or exceed FDOT specifications.
- B. Turbidity barriers meeting FDOT Type I and Type II requirements shall be provided where required by Part 3. Turbidity barrier may be floating or staked, based on the conditions at the location for installation. Turbidity barrier shall be capable of functioning properly for flow conditions up to a 5 year/24 hour storm event. Turbidity barriers shall be constructed of PVC or polypropylene material, all portions which will be exposed to direct sunlight shall be ultraviolet resistant. All metal components shall be corrosion resistant. Woven materials may be acceptable for installations where high flow conditions may exist during storm events. Turbidity barriers shall be "Mark I", "Mark II", or "PC-2" as manufactured by American Boom & Barrier Corporation, Cape Canaveral, FL or equal.
- C. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, rye, or hay that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be

10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

- D. Latex acrylic copolymer, such as Soil Sealant with coalescing agent as manufactured by Soil Stabilization Co., Merced, CA or approved equivalent shall be used as straw mulch tackifier.
- E. An asphalt tackifier may be used in place of a latex acrylic copolymer with prior written approval from the ENGINEER.
- F. Baled Hay or Straw: This work shall consist of construction of baled hay or straw dams to protect against downstream accumulations of silt. The baled hay or straw dams shall be constructed in accordance with the details in the FDOT Roadway and Traffic Design Standards. All baled hay or straw utilized shall comply with the provisions of FDOT Specification Section 9811-3.1 for dry mulch.

PART 3 - EXECUTION

3.1 LOCATION OF SEDIMENT/EROSION CONTROL AND TURBIDITY BARRIERS

- A. At a minimum, sediment/erosion control devices shall be installed at all locations shown on the plans and specified herein.
- B. Sediment/erosion control devices shall be installed at 500 feet intervals along all swales and ditches constructed and around all installed drainage structures prior to placement of sod.
- C. Sediment/erosion control shall be installed along all limits of construction.
- D. Sediment control or turbidity barriers shall be installed along the upstream side of all littoral zones within stormwater ponds. Sediment control or turbidity barriers shall be installed along the open water side of all littoral zones in borrow areas in which excavation is being conducted.
- E. Turbidity barriers shall be installed in all waters of the U.S. and the stormwater drainage ditch. Clearing of vegetation 20 feet upstream and downstream of the turbidity barriers is required.
- F. CONTRACTOR shall provide additional sediment/erosion control and turbidity barriers as needed to control the transport of silt and sediments outside of the limits of construction.
- G. Sediment/erosion control shall be installed around the base of all soil stockpile areas. All non-working faces of soil stockpiles, which will be in place longer than one month

shall be seeded in accordance with the temporary seed requirements in Division 02 Section Grassing.

- H. Sediment/erosion control devices shall be installed along the perimeter of all staging areas.
- I. Sediment/erosion control for all construction activities which take place within an existing Jurisdictional Wetland (SWFWMD and FDEP), which will only be partially impacted by construction shall have double sediment/erosion control barriers. The separation between the double barriers shall be at least 5 feet, but no greater than 10 feet.
- J. All disturbed areas, greater than one (1) acre, in which construction activities have stopped and are not anticipated to resume for a period of three months or longer shall be temporarily seeded, within five days of stoppage of construction, in accordance with the temporary seeding requirements in Division 02 Section Grassing.
- K. All disturbed areas, greater than one (1) acre, in which construction activities have been stopped and are not anticipated to resume for a period of 21 days, but not longer than three months shall be temporarily mulched, within five days of stoppage of construction in accordance with Paragraph 3.4

3.2 INSTALLATION

A. Silt Fence Installation

1. Silt fences shall be positioned facing the drainage flow and as necessary to prevent movement of sediment produced by construction activities outside of the limits of construction or as approved.
2. All silt fence is to be installed prior to commencement of any construction activities uphill of silt fence location.
3. Dig trench approximately 6-in wide and 8-in deep along proposed fence lines.
4. Drive metal-stakes, 8 feet on center (maximum) at back edge of trenches. Stakes shall be driven 2 feet (minimum) into ground.
5. Hang 4 by 4 woven wire mesh on posts, setting bottom of wire in bottom of trench. Secure wire to posts with self-fastening tabs.
6. Hang filter fabric on wire carrying to bottom of trench with about 4-in of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and secure with tie wires 12-in O.C. both ways.
7. Backfill trench with excavated material and tamp.
8. Install FDOT approved, pre-fabricated, silt fence according to MANUFACTURER's instructions.

B. Hay bale Barrier

1. Bales shall be either wire-bound or string-tied with the bindings oriented around the sides rather than over and under the bales.

2. Bales shall be placed lengthwise in parallel rows with the ends of adjacent bales tightly abutting one another and rows staggered.
3. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After bales are staked and chinked, the excavated soil shall be backfilled against the barrier. Backfilled material shall conform to the ground level on the downhill side and shall be built up to 2 inches against the uphill side.
4. Each bale shall be securely anchored by at least two stakes or rebars driven through the bale. The first stake shall be driven toward the previously laid bale to force the bales together. Stakes shall be driven deep enough into the ground to securely anchor the bales. The gaps between each bale shall be chinked (filled by wedging) with straw to prevent water from escaping between the bales
5. Where placed in concert with the required silt fencing, a second row of silt fencing paralleling the first at five foot spacing may be substituted for the rows of hay bales provided performance is not compromised.

C. Turbidity Barriers

1. Turbidity barriers should extend the entire depth of the water.
2. Turbidity barriers should not be placed perpendicular to flow. Barriers should be installed at an angle to the flow. Angle should be determined on the amount of flow in the waterway and the MANUFACTURER's recommendation.
3. Turbidity barrier should be 10 to 20 percent longer than the straight line measurement.
4. Joints between panels should be kept to a minimum.
5. Barrier should extend to the top of bank. All ends should be secured firmly to the shoreline.
6. Where significant flow is anticipated, a heavy woven pervious filter fabric may be substituted.

D. Erosion Control and Excelsior Matting

1. Erosion control and excelsior matting blankets shall be installed as shown on the drawings and as approved in accordance with MANUFACTURER's instructions. The area to be covered shall be properly prepared before the blanket is applied. When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow, and stapled. Blankets shall be placed a minimum of three rows (of 4- ft) wide (total approx. 12-ft width) and stapled together in accordance with MANUFACTURER's instructions. Side overlaps shall be 6-in minimum. The staples shall be made of wire, .091-in in diameter or greater, "U" shaped with legs 10-in in length and a 1-1/2 -in crown. The staples shall be driven vertically into the ground, spaced approximately 2 linear feet apart, on each side, and one row in the center alternately spaced between each side. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. The bottom of the fold shall be 4-in below the ground surface. Staple on both sides of fold. Where the matting must be cut or more than one roll length is required, turn down upper

- end of downstream roll into a trench to a depth of 4-in. Overlap lower end of upstream roll 4-in past edge of downstream roll and staple.
2. To ensure full contact with soil surface, roll matting with a roller weighing 100 pounds per foot of width perpendicular to flow direction after placing matting, stapling and seeding. Thoroughly inspect installation after completion. Correct any areas where matting does not present a smooth surface in full contact with the soil below.

3.3 MAINTENANCE AND INSPECTIONS

A. Inspections

1. CONTRACTOR shall make a visual inspection of all sedimentation and erosion control devices (including turbidity barriers) once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to areas outside the limits of construction, CONTRACTOR shall promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.
2. CONTRACTOR shall keep a log of all inspections indicating the following:
 - a. Date and time of inspection
 - b. Inspector
 - c. Amount of rainfall since last inspection
 - d. Erosion and sediment control devices inspected
 - e. Condition of sediment and erosion control devices
 - f. Repairs needed
 - g. Date repair is completed

B. Device Maintenance

1. Silt Fences
 - a. Remove accumulated sediment once it builds up to one-half of the height of the fabric.
 - b. Replace damaged fabric, or patch with a 2-ft minimum overlap.
 - c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.
2. Hay bale Barriers
 - a. Remove accumulated sediment once it builds up to one-half of the height of the hay bales.
 - b. Replace damaged hay bales.
 - c. Make other repairs as necessary to ensure that the hay bales are filtering all runoff directed to the barrier.
3. Turbidity Barriers
 - a. Turbidity barriers shall be inspected on a daily basis.
 - b. Replace damaged fabric, or patch with a 2 foot minimum overlap.
 - c. Make other repairs as necessary to ensure barriers are effectively maintaining turbidity levels outside of the barrier.

3.4 TEMPORARY MULCHING

- A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 21 days of the completion of rough grading. If construction activities are not planned to resume for three months or longer, the temporary seeding requirements shall be followed.
- B. Straw mulch shall be applied at rate of 2,000 lbs/acre and tackified with latex acrylic copolymer at a rate of 1 gal/1000 ft² diluted in a ratio of 30 parts water to 1-part latex acrylic copolymer mix.
- C. After temporary mulching, traffic should be kept to a minimum, except for designated temporary access roads.

3.5 SEDIMENT BASINS

- A. The stormwater ponds may serve as sediment traps during the term of construction.
- B. The CONTRACTOR shall monitor the depth of sediment in each stormwater pond on a monthly basis and after each storm which produced greater than one (1) inch of rainfall. Sediments shall be removed from the stormwater ponds when they constitute one-half of the volume below the normal pool elevation. CONTRACTOR shall excavate all stormwater ponds to their original design depths after all areas served by the pond have reached substantial completion and all soil has been stabilized. All underdrains shall be reestablished to their design condition.

3.6 REMOVAL AND FINAL CLEANUP

- A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Drawings or specified herein.

END OF SECTION 02270

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SECTION 02619

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to install ductile iron pipe and fittings complete, tested, and ready for use, as shown on the Drawings and/or as specified herein.

1.2 RELATED WORK (REQUIREMENTS)

- A. The Contract Documents include, but are not limited to, the following related requirements:
 - 1. Site Preparation is included in Section 02100.
 - 2. Trenching, Bedding, Backfilling and Compaction for Pipe are included in Section 02221.
 - 3. Polyvinyl Chloride (PVC) Pressure Pipe is included in Section 02622.

1.3 SUBMITTALS

- A. The CONTRACTOR shall submit to the ENGINEER, within twenty (20) calendar days after receipt of Notice to Proceed, a list of materials to be furnished, and the names of the suppliers and the date of delivery of materials to the site.
- B. Submit shop drawings to the ENGINEER for review in accordance with Section 01300, showing the complete laying plan of all pipe, including all fittings, adapters, valves, and specials along with the MANUFACTURER's drawings and specifications indicating complete details of all items. The pipe details shall include a pipe class laying schedule which specifies pipe class, class coding, joints, station limits, and transition stations, and a list of abbreviated terms with their full meaning. The CONTRACTOR shall provide details of fittings to be furnished. The above shall be submitted to the ENGINEER for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated on the Drawings. In most cases, a certain amount of flexibility in the positioning of pipes will be allowed. Horizontal and vertical deflections may require beveled, special deflection; or short pipes. The deflections at joints shall not exceed 75 percent of that recommended by the MANUFACTURER.

- C. Furnish in duplicate to the ENGINEER, prior to each shipment of pipe, MANUFACTURER's certification and certified test reports that the pipe and linings and coating for this contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.

1.4 QUALIFICATIONS

- A. All ductile iron pipe and fittings shall be furnished by MANUFACTURER's who are fully experienced, reputable, and qualified in the manufacture of the material to be furnished. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.5 QUALITY ASSURANCE

- A. All ductile-iron pipe and fittings shall be from a single MANUFACTURER. All ductile-iron pipe to be installed under this contract may be inspected at the foundry for compliance with these specifications by an independent testing laboratory provided by the OWNER. The CONTRACTOR shall require the MANUFACTURER's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this contract will be borne by the OWNER.
- B. Inspection of the pipe will also be made by the ENGINEER or other representatives of the OWNER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.
- C. Each joint of ductile iron pipe shall be hydrostatically tested at the point of manufacture to 500 psi for a duration of at least ten (10) seconds. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture of pipe wall. Certified test certificates shall be furnished in duplicate to the ENGINEER prior to time of shipment.

1.6 CONNECTION TO EXISTING LINES

- A. Lines installed under other Contracts, to which piping of this Contract must connect, the following work shall be performed:
 - 1. Removing the temporary or permanent plug provided in the pipe installed under another Contract (if any).
 - 2. Furnishing and installing piping and accessories and making proper connections.

- B. For connections to the existing lines to which the piping of this Contract must connect, the following work shall be performed:
 - 1. Exposed buried lines to confirm or determine end connection, pipe material, and diameter.
 - 2. Furnish and install appropriate piping and make proper connections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ductile iron pipe and fittings 3-inches through 54-inches for buried service shall meet the following requirements:
 - 1. Ductile iron pipe shall conform to ANSI A21.51 and AWWA C-151. Ductile iron pipe shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi and a minimum elongation of 10 percent. Thickness of pipe supplied shall not be less than Class 51 unless specifically indicated on the Drawings or specified herein. Type of bedding conditions used shall be as shown on the Drawings. Ductile iron pipe and fittings in below grade structures shall be flanged Class 53.
 - 2. Unrestrained joint pipe shall be supplied in lengths not in excess of 21 feet. Unrestrained joint pipe shall be either the rubber-ring type, push-on joint, or standard mechanical joint pipe as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, Clow Corp., or equal.
 - 3. Unrestrained fittings shall meet the requirements of AWWA C-110. Rubber gaskets shall conform to ANSI A21.11 for mechanical and push-on type joints. Mechanical joint fittings and restrained joint pipe shall be furnished with sufficient quantities of accessories as required for each joint.
 - 4. Restrained joint fittings where shown or specified shall be manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51, C110/A21.10 and C111/A21.11. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C111/A21.11. Pipe thickness shall be designed in accordance with ANSI/AWWA C150/A21.50 and C151/A21.51. Restrained joint fittings shall be ductile iron in accordance with applicable requirements of ANSI/AWWA C110/A21.10. Mechanical joints for such fittings shall be in accordance with ANSI/AWWA C110/A21.10 and C111/A21.11. Restrained joints, where shown or specified, shall be designed to withstand vertical and longitudinal forces and be capable of holding against withdrawal with no axial movement resulting from an internal hydrostatic pressure of 120 psi for the raw sewage force mains and 150 psi for reclaimed water irrigation mains and potable water mains.
 - 5. All buried service pipe and fittings shall be ductile iron and shall have push-on type line joints and all fittings shall be mechanical joint, unrestrained or restrained.
 - 6. Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out

that corresponds with the minimum specified wall thickness for the rest of the pipe.

7. Restrained joints shall be suitable for 120 psi or 150 psi working pressure for purpose as specified above and fabricated of heavy section ductile iron casting. Gaskets shall meet the material requirements of ANSI/AWWA C111 for mechanical joint gaskets. Bolts and nuts on mechanical joint or flanged joint pipe and fittings, above and below ground shall be low alloy, high strength steel equal to "Corten" conforming to ANSI A21.11 and A21.15 for Class 125 ANSI B16.1 for the purpose intended. Restrained joints for buried pressure piping and fittings shall "Super-Lock" as manufactured by the Clow Corporation; "Flex-Ring" and "Lok-Ring" as manufactured by the American Cast Iron Pipe Company; "TR-FLEX" as manufactured by U.S. Pipe and Foundry Company; or equal, or Megalug retainer glands as manufactured by EBAA Iron, Inc. for mechanical joint pipe and fittings. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil as shown on the drawings.
8. Ductile iron fittings, valves and other appurtenances shall be wrapped with polyethylene film where shown on the Drawings or specified herein. Polyethylene shall conform to AWWA C105. Polyethylene shall be manufactured of virgin polyethylene material conforming to the requirements of ASTM D1248. Raw materials used to manufacture polyethylene film shall be Type I, Class C (black), Grade E-1. Polyethylene film shall have a tensile strength of 1200 psi (min.), elongation of 300 percent (min.) and a dielectric strength of 800 volt/mil thickness (min.). Polyethylene film shall have a minimum nominal thickness of 0.008 in. (8 mils). Tape shall have a minimum thickness of 8 mils and a minimum width of 1-inch. The polyethylene film envelope shall be free as is commercially possible of gels, streaks, pinholes, particles of foreign matter, and undispersed raw materials. There shall be no other visible
9. defects such as holes, tears, blisters, or thinning out at folds. Exposure to weather shall be kept to a minimum and in no case shall it exceed ten (10) days. MANUFACTURER's shall furnish a certification of conformance of the material to the requirement of AWWA C-105 or ANSI A21.5.
10. Adapters to connect ductile iron fittings to pipe or fittings of dissimilar materials shall be supplied by the CONTRACTOR in accordance with the pipe MANUFACTURER recommendations, and as approved by the ENGINEER.
11. Pipe outlets where shown shall be made with tees, tapping saddles or factory welded-on bosses for above ground piping. Bosses shall be ductile iron, factory welded on ductile iron pipe having a minimum Pressure Class 350 for 6-inch to 12-inch sizes, Pressure Class 250 for 16-inch to 36-inch sizes, and Pressure Class 350 for 42-inch to 48-inch sizes.
12. Flexible joint pipe shall be ball and socket type self-restraining without the use of bolts and designed for a maximum working pressure of 350 psi having a class rating as recommended by the MANUFACTURER, but a minimum Class 56 for

4-inch to 24-inch sizes. Boltless restraint shall be achieved by external lugs interlocked into a retainer gland. Each joint shall be capable of a maximum deflection of 15 deg. Flexible joint pipe shall be USIFLEX by U.S. Pipe and Foundry Company, Flex-Lok Boltless Ball Joint Pipe by American Cast Iron Pipe Company or equal. Subaqueous canal crossings shall be either flexible ball and joint pipe or Class 53 factory restrained mechanical joint pipe, fitting and accessories. All bolts and accessories shall be "Corten", conforming to ANSI A21.11 and shall be drilled to match ANSI B16.1, Class 125 or 250 for the purpose intended.

13. CONTRACTOR may supply short body ductile iron fittings in conformance with AWWA C153 in lieu of C110 and C111 for sizes 3-inch through 24-inch.
 14. All fittings shall be cast and machined at one foundry location to assure quality control and test data. The standard grade of iron shall be 70-50-05. Analyses of the ductile iron shall be made with the chemical limits set in this standard (C110 and/or C153). Results of chemical analyses shall be provided to the ENGINEER as part of the shop drawings.
- B. Ductile iron pipe and fittings 3-inches through 54-inches for above ground service or in below ground concrete pits shall meet the following requirements:
1. Ductile iron pipe shall conform to ANSI A21.51 and AWWA C-151. Thickness of pipe shall be a minimum of Class 53 for all sizes of flanged pipe.
 2. Flanged ductile-iron pipe shall conform to current AWWA/ANSI Specification C115/A21.15 and C110/A21.10 with factory-applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be fully machined faced and drilled after being screwed tight on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B161.1, 125-pound std. or Class 250, for the purpose intended. No welding of flanges or accessories in the field will be acceptable.
 3. Pipe for use with split-type flexible coupling joints shall have radius grooved ends.
 4. Wall sleeve with integral water stops, or wall pipe casings with integral thrust collars shall be continuously welded on each side of the waterstop or thrust collar and shall be of the sizes and types as shown on the Drawings. Wall sleeves, where specified, shall be fabricated of Schedule 40 Type 316 stainless steel or PVC and shall have integral water stops continuously welded on each side of the waterstop. Seal strips for wall sleeves, where required on the Drawings, shall be Link Seal as manufactured by Thunderline Corp., Wayne, Michigan, or equal.
 5. Full face type 1/16-inch thick red rubber ring gaskets shall conform to ANSI A21.11. Ring gaskets shall be of approved composition suitable for the required service.
 6. Pipe and fittings exposed to view in the finished work and to be painted in accordance with Division 9 shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Kop Coat No. 622 Rust Inhibitive Primer or equal. Should portions of the pipe inadvertently be given the outside bituminous coating instead of the rust inhibitive primer as required for exposed piping the surfaces shall be sealed with a

non-bleeding sealer coat such as Kop Coat Tar Stop, Mobil Anti-Bleeding Aluminum Sealer or Aqua Lock Glidden. Sealing shall be a part of the work of this section.

7. Bolts and nuts on flanged pipe and fittings shall be low alloy, high strength steel equal to "Corten," conforming to ANSI A21.11 and A21.15 or 304 stainless steel and shall be drilled to match ANSI B16.1 Class 125 or 250 flanges for the purpose intended.

2.2 LINING AND COATINGS

- A. All pipe and fittings for water and reclaimed water mains shall have a cement mortar lining and a bituminous seal coat on the inside in accordance with ANSI A21.4 and be coated on the exterior with a 1-2 mils thick bituminous coat in accordance with ANSI A21.51.
- B. All ductile iron pipe and fittings for wastewater service (including but not limited to raw sewage lines, all process lines, and reject water lines) including pressure and gravity mains, unless otherwise noted, shall have a ceramic epoxy lining on the interior and bituminous coating on the exterior except for 6 inches back from the spigot end. The bituminous coating shall not be applied to the first 6 inches of the exterior of the spigot ends. All pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this specification is that the entire interior of the pipe and fittings shall be as cast without ever having been lined with any substance prior to the application of the specified lining. Any pipe or fittings furnished for this project must not have been lined prior to the awarding of the contract for this project.
 1. Lining Material - The material used for the lining shall be a two-component amine cured epoxy of at least 87 percent solids. Protecto 401 by Vulcan Painters, Birmingham, Alabama or Permit 9043, Type II Glass Filled Epoxy by Permite Corporation, Atlanta, Georgia are the Standards of Quality. The following test requirements shall be certified by the material supplier, and a history of satisfactory performance for the material in the service required and upon the surface specified shall be submitted. The following are the minimum requirements to be met:
 - a. A permeability rating of zero permeance when a film of at least 40 mils is tested according to ASTM D1653 or a permeability rating of 0.0 perms when measured using Method A of ASTM E66 procedure A with a test duration of 42 days.
 - b. The material shall contain at least 20 percent by volume of ceramic quartz pigment in the dried film.
 - c. The following test and rating/method must be run on ductile iron panels with the results certified by the lining material supplier of the material being submitted.
 - 1) Direct Impact: ASTM D-2794
 - 2) 3% Sulfuric Acid Immersion @ 120/F: ASTM D-714

- 3) 25% Sodium Hydroxide Immersion @ 140/ F: ASTM D-714
 - 4) Deionized Water Immersion @ 160/ F: ASTM D-714
 - 5) Moisture and Ultraviolet Light Cycle 8 Hours Light / 4 Hours 100% Humidity: ASTM G-5377
2. Application of Lining - The lining shall be applied by a competent firm with at least a five-year history of applying linings to the interior of ductile pipe and fittings.
- a. Surface Preparation: Prior to abrasive blasting, the entire area which will receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease, or any substance which can be removed by solvent is present shall be solvent cleaned using the guidelines outlined in SSPC-SP-1 Solvent Cleaning. After the surface has been made free of grease, oil, or other substances, all areas which are to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The blast media shall strike 100 percent of the surface area at sufficient force to remove rust and oxides. The entire surface to be lined shall be struck with the blast media so that all rust, loose, oxides, etc., are removed from the surface. Only slight stains and specks of tightly adhering oxides may be left on the surface. Any area where rust appears before coating must be reblasted to remove all rust.
 - b. Lining: After surface preparation and within 8 hours of surface preparation of the barrel of the pipe from the inside shoulder of the gasket groove to the end of the interior spigot shall receive a minimum coating of 40 mils dry film thickness of the protective lining. If flange fittings or pipe are included in the project the linings must not be used on the face of the flange; however, full face gaskets must be used to protect the ends of the pipe. All fittings shall be lined with a minimum of 40 mils of the protective lining. Push-on type fittings shall be lined from the gasket groove to the gasket groove. The 40 mils system shall not be applied in the gasket grooves.
 - c. Coating of Gasket Groove and Spigot Ends: Due to the tolerances involved, the gasket groove and spigot end up to 6 inches back from the end of the spigot end must be coated with a minimum of 10 mils dry of Protecto Joint Compound. This coating shall be applied by brush to ensure coverage. Care should be taken that the coating is smooth without excess buildup in the gasket groove or on the spigot end. All materials for the gasket groove and spigot end shall be applied after the application of the lining.
 - d. Number of Coats: The number of coats of lining material applied shall be as recommended by the lining MANUFACTURER. However, in no case shall the material be applied above the dry thickness per coat recommended by the lining MANUFACTURER in printed literature. The time between coats shall never exceed that time recommended by the lining material MANUFACTURER. If at any time the lining must be recoated beyond the lining material MANUFACTURER's recommended recoat time, the surface of the existing lining shall be roughened sufficiently to prevent delamination between coats.

3. Inspection:
 - a. All pipe shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 film thickness testing.
 - b. The barrel of all pipe and fittings shall be pinhole detected with a nondestructive 2,500-volt pinhole test.
 - c. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on that date.
4. Certification: The pipe or fitting MANUFACTURER must supply a certificate attesting to the fact that the Applicator met the requirements of this specification, that the material used was as specified, and that the material was applied as required by the specification.
5. Repair: All pinholes and damaged lined areas shall be repaired in accordance with written repair procedure furnished by the MANUFACTURER of the lining material so that the repaired area is equal in performance to the undamaged lined areas.
6. The exterior of the pipe shall receive a bituminous coating approximately 1-2 mils thick in accordance with ANSI A21.51.
7. Pipe and fittings exposed to view in the finished work shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Kop Coat No. 622 Rust Inhibitive Primer or equal and painted in accordance with the coatings sections of these specifications. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping, the surfaces shall be sealed with a non-bleeding sealer coat such as Kop Coat Tar Stop, Mobil Anti-Bleeding Aluminum Sealer, or equal. Sealing shall be a part of the work of this section.

2.3 IDENTIFICATION

- A. Each length of pipe and each fitting shall be marked with the name of the MANUFACTURER, size, and class. All gaskets shall be marked with the name of the MANUFACTURER, size, and proper insertion directions.
- B. All below ground ductile iron pipe and fittings shall have an identification color code.
 1. Raw sewage force mains and gravity sewer pipe - Green, similar to Kop Coat, No. 0336.
 2. Reclaimed water irrigation reuse mains and service tubing - Purple, similar to Pantone 522C. Marking tape color shall be red, similar to Kop Coat No. 0508.
 3. Potable water mains and service tubing - Blue, similar to Kop Coat No. 8155.
- C. All buried ductile iron pipe shall be painted along its entire length with 2-inch stripes on at least three quarter points for pipe sizes 12-inches and larger. For pipe sizes smaller

than 12-inches, a single 2-inch wide stripe along the top of the pipe shall be provided. Paint and marking tape colors shall be as described above.

2.4 FUTURE STRUCTURE AND MANHOLE CONNECTIONS

- A. Pipe stubs for all future manhole connections shall not be less than 24-inches in length. Watertight plugs or caps shall be furnished.

PART 3 - EXECUTION

3.1 INSTALLING DUCTILE IRON PIPE AND FITTINGS

- A. All water, sewer, and reclaimed water mains shall be installed in accordance with recommendations of the pipe MANUFACTURER and as specified herein.
- B. Care shall be taken in the handling, storage, and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installing, and no pipe shall be installed which is found to be defective. Pipe or fittings shall not be dropped. All damage to the pipe coatings shall be repaired according to the MANUFACTURER's recommendations.
- C. All pipe and fittings shall be kept clean and shall be thoroughly cleaned before installation.
- D. Pipe shall be laid to the lines and grades shown on the Drawings with bedding and backfill as shown on the Drawings. Blocking under the pipe will not be permitted.
- E. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when laid, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be constructed by tamping FDOT No. 89 stone at the sides of the pipe up to 6-inches over the top of the pipe, and then an additional 6 inches of selected material for a total of 12 inches over the top of the pipe. Blocking will not be permitted. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner by the CONTRACTOR, at his own expense.
- F. When installation is not in progress, including lunchtime, or the potential exists for dirt of debris to enter the pipe, the open ends of the pipe shall be closed with watertight plugs or other approved means.
- G. Under no circumstances shall the pipe or accessories be dropped into the trench.

- H. All plugs, caps, bends and other locations where unbalanced forces exist shall be anchored by restrained joints. The length of pipe for which restrained joints shall be used are shown on the Drawings.
- I. In all cases where ductile iron pipe is installed, a marking tape shall be located above the top of the pipe.
- J. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be jointed with a bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.

3.2 PUSH-ON JOINTS

- A. Push-on joints shall be made in accordance with the MANUFACTURER's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be laid shall then be aligned and inserted in the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

3.3 MECHANICAL JOINTS

- A. Mechanical joints shall be made in accordance with Appendix A of ANSI/AWWA C111 and the MANUFACTURER's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket with soapy water before assembly. Bolts shall be tightened to the specified torques. Under no conditions shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage.

3.4 FLANGED JOINTS

- A. Flanged joints shall be installed where shown on the Drawings. Extreme care shall be exercised to ensure that there is no restraint on opposite ends of pipe or fitting which will prevent uniform gasket compression, cause unnecessary stress, bending or torsional strains to flanges or flanged fittings. Adjoining push-on joints shall not be assembled until flanged joints have been tightened. Bolts shall be tightened alternately and evenly. After installation apply a bitumastic coating to bolts and nuts.

3.5 RESTRAINED JOINTS

- A. Restrained joints shall be installed at all fittings as shown on the Drawings and specified herein. The joint assemblies shall be made in accordance with the MANUFACTURER's

recommendations. After installation, apply a heavy bitumastic coating to all bolts, nuts and accessories.

3.6 FLEXIBLE JOINT PIPE

- A. The flexible joint pipe shall be installed in accordance with the MANUFACTURER's recommendations. In addition, the installed deflection shall be limited to 12 deg. per joint and provisions shall be made where required to prevent flotation or buoyancy of the pipe.

3.7 SLEEVE TYPE COUPLINGS

- A. Couplings shall be installed where shown. Couplings shall not be assembled until adjoining push-on joints have been assembled. After installation, apply a heavy bitumastic coating to all bolts, nuts and accessories.

3.8 POLYETHYLENE ENCASEMENT

- A. The polyethylene encasement shall be installed in accordance with either method specified in ANSI/AWWA C105.

3.9 GRAVITY SEWER CONFLICT PIPING

- A. Installation of ductile iron gravity sewer pipe and fittings, where specified for pipeline conflicts, shall be as specified in Article 2.1 (A) above.

3.10 TESTING (PRESSURE PIPING)

- A. All pressure mains shall be field tested. Hydrostatic pressure and leakage tests shall conform to Section 4 of AWWA C600 Specification with the exception that the CONTRACTOR shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.
- B. The pressure required for the field hydrostatic pressure test shall be 150 psi, unless otherwise noted. The CONTRACTOR shall provide temporary plugs and blocking necessary to maintain the required test pressure. Fill line slowly with water. Maintain flow velocity of less than 2.0 feet per second. Corporation cocks at least 1- inch in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least 2 hours. The cost of these items shall be included as a part of testing.
- C. The leakage test shall be a separate test at the maximum operating pressure as determined by the ENGINEER following the pressure test and shall be of not less than 2 hours

duration. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

- D. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such sections as may be approved by the ENGINEER by shutting valves or installing temporary plugs as required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the CONTRACTOR. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.
- E. The amount of leakage which will be permitted shall be in accordance with AWWA C600 Standards for all pressure. No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{S D(P)^{1/2}}{133,200}$$

- 1. L is the allowable leakage in gallons per hour.
 - 2. S is the length of pipe tested, in feet.
 - 3. D is the nominal diameter of the pipe, in inches.
 - 4. P is the average test pressure during the leakage test, in pounds per square inch gauge.
- F. The CONTRACTOR must submit his plan for testing to the ENGINEER for review at least ten (10) days before starting the test. The CONTRACTOR shall remove and adequately dispose of all blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise approved by the ENGINEER. Any damage to the pipe coating shall be repaired by the CONTRACTOR. Lines shall be totally free and clean prior to final acceptance.

3.11 TESTING (GRAVITY SEWERS)

- A. Testing and cleaning of gravity sewer lines shall be as specified in Section 02556A - Water Main and Force Main Cleaning.

3.12 CHLORINATION OF PIPELINES

- A. Before being placed in service, all new reclaimed water mains including service connections and accessories shall be chlorinated using the continuous feed method specified in AWWA C651 "Standard Procedure for Disinfecting Water Mains." The procedure shall be approved by the ENGINEER in advance.

- B. The location of the chlorination and sampling points shall be determined by the ENGINEER in the field. Taps for chlorination and sampling shall be installed by the CONTRACTOR. The CONTRACTOR shall uncover and backfill the taps as required.
- C. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for about 24 hours.
- D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities, and replaced with water from the distribution system. All treated water flushed from the lines shall be disposed of by discharging to the nearest sanitary sewer or by other approved means. No discharge to any storm sewer or natural water course will be allowed. Bacteriological sampling and analysis of the replacement water shall then be made by the ENGINEER in full accordance with AWWA Specification C651. The CONTRACTOR will be required to rechlorinate, if necessary. The line shall not be placed in service until the requirements of the State and County Public Health Department are met.
- E. Special disinfecting procedures shall be used in connections to existing mains and where the method outlined above is not practical.
- F. The CONTRACTOR shall make all arrangements necessary with the County Health Department for examination of samples of water from disinfected water mains. These samples shall be examined for compliance with Department of Health and Rehabilitative Services requirements. Sampling shall be made daily and continuously until two successive examinations are found satisfactory. Should three examinations be found unsatisfactory, the line shall be flushed and disinfected again. The cost of all sampling, flushing and disinfecting shall be included in the contract price and no additional charge shall be made to the OWNER for this work.

3.13 CLEANING

- A. At the conclusion of the work the CONTRACTOR shall thoroughly clean all of the new pipelines by flushing with water to remove all dirt, stones, pieces of wood, or other material that may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed.
- B. After the pipelines are cleaned and if the groundwater level is above the pipe, or following a heavy rain, the ENGINEER will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired or replaced by the CONTRACTOR.

END OF SECTION 02619

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SECTION 02622

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to install polyvinyl chloride (PVC) pipe and ductile iron fittings for all PVC mains complete, tested, and ready for use, as shown on the Drawings and/or as specified herein.

1.2 RELATED REQUIREMENTS

- A. Construction Drawings, Agreement Declarations, Exhibits and other Technical Specification Sections apply to this Section.

1.3 SUBMITTALS

- A. The CONTRACTOR shall submit to the ENGINEER, within twenty (20) calendar days after receipt of Notice to Proceed, a list of materials to be furnished, and the names of the suppliers and the date of delivery of materials to the site.
- B. Submit shop drawings to the ENGINEER for review in accordance with Section 01300, showing the complete laying plan of all pipe, including all fittings, adapters, valves, and specials along with the MANUFACTURER's drawings and specifications indicating complete details of all items. The pipe details shall include a pipe class laying schedule which specifies pipe class, class coding, joints, station limits, and transition stations, and a list of abbreviated terms with their full meaning. The CONTRACTOR shall provide details of fittings to be furnished. The above shall be submitted to the ENGINEER for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated on the Drawings. In most cases, a certain amount of flexibility in the positioning of pipes will be allowed. Horizontal and vertical deflections may require beveled, special deflection; or short pipes. The deflections at joints shall not exceed 75 percent of that recommended by the MANUFACTURER.
- C. Furnish in duplicate to the ENGINEER, prior to each shipment of pipe, submit MANUFACTURERs certification and certified test reports that the pipe and linings and coating for this contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.

1.4 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 2. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 3. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
 - 4. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 5. ASTM D2467 - Standard Specification for Socket - Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 6. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 - 7. ASTM D2657 - Standard Practice for Heat-Joining Polyolefin Pipe and Fittings.
 - 8. ASTM D2855 - Standard Practice for Making Solvent - Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 - 9. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - 10. ASTM F438 - Standard Specification for Socket - Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
 - 11. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
 - 12. ASTM F441 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
 - 13. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
 - 14. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
 - 15. ASTM F594 - Standard Specification for Stainless Steel Nuts.
- B. American Water Works Association (AWWA)
 - 1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water and Other Liquids.
 - 2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
 - 3. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances.
 - 4. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4-in through 12-in for Water.
 - 5. AWWA C905 - Polyvinyl Chloride (PVC) Water Transmission Pipe, nominal diameter 14-in through 36-in.
- C. National Sanitation Foundation (NSF)

- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 QUALIFICATIONS

- A. All polyvinyl chloride pipe and fittings shall be furnished by MANUFACTURERS who are fully experienced, reputable, and qualified in the manufacture of the material to be furnished. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.6 QUALITY ASSURANCE

- A. All PVC pipe shall be from a single MANUFACTURER. All PVC pipe to be installed under this contract may be inspected at the factory for compliance with these specifications by an independent testing laboratory provided by the OWNER. The CONTRACTOR shall require the MANUFACTURER's cooperation in these inspections. The cost of factory inspection of all pipe approved for this contract, will be borne by the OWNER.
- B. Inspection of the pipe will also be made by the ENGINEER or other representatives of the OWNER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery, Storage, and Handling is specified in Division 1, Section 01600 " Delivery, Storage, and Handling."
- B. Care shall be taken in shipping, handling and laying to avoid damaging the pipe and fittings. Extra care will be necessary during cold weather construction. Any pipe damaged in shipment shall be replaced as approved by the ENGINEER.
- C. Any pipe or fitting showing a crack or which has received a blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- D. While stored, pipe shall be adequately supported from below at not more than 3-ft intervals to prevent deformation. Pipe shall not be stacked higher than 6-ft. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures. Temporary shading as required to meet this requirement shall be provided.

Simple covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted. Pipe covering shall be in conformance with the MANUFACTURER's recommendations.

- E. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight or delivered to the site so that no pipe is exposed to sunlight for more than 60 days.

1.8 TOOLS

- A. Special tools, solvents, lubricants, and caulking compounds if required for normal installation shall be furnished with the pipe.

1.9 CONNECTION TO EXISTING LINES

- A. Lines installed under other Contracts, to which piping of this Contract must connect, the following work shall be performed:
 - 1. Removing the temporary or permanent plug provided in the pipe installed under another Contract (if any).
 - 2. Furnishing and installing piping and accessories and making proper connections.
- B. For connections to the existing lines to which the piping of this Contract must connect, the following work shall be performed:
 - 1. Exposed buried lines to confirm or determine end connection, pipe material, and diameter.
 - 2. Furnish and install appropriate piping and make proper connections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe (Class-Rated): PVC pressure pipe and accessories four to twelve inches (4"-12") in diameter, where shown or as specified on the Drawings, shall meet the requirements of AWWA Specification C900 "Polyvinyl Chloride (PVC) Pressure Pipe" and AWWA C905 for PVC pipe from fourteen to thirty-six inches (14"-36") in diameter. Pipe shall be Class 150, meeting requirements of Dimension Ratio (DR) 18 for 14" – 24" diameter, and DR 25 for 30" and 36" diameter, and shall be designed with cast iron outside diameters and for a working pressure of 150 psi. Each length of pipe shall be hydrotested to four (4) times its class pressure by the MANUFACTURER in accordance with AWWA C900 and C905. Pipe shall be listed by Underwriters Laboratories. Provisions shall be made for expansion and contraction at each joint with an elastomeric ring, and shall have an integral thickened bell as part of each joint. PVC Class pipe shall be installed in accordance with the Uni-Bell Plastic

Pipe Association Guide Specification UNI-B-3-76, and as recommended by the MANUFACTURER. Pipe shall be furnished in nominal lengths of approximately 20 feet, unless otherwise approved by the ENGINEER. Pipe and accessories shall bear the NSF mark indicating pipe size, MANUFACTURER's name, AWWA and/or ASTM Specification number, working pressure, and production code. Pipe and couplings shall be made from Class 12454-A or Class 12454-B virgin compound, as designed in ASTM D1784. PVC pressure pipe less than 4 inches in diameter shall be ASDM D2241 Class 200.

B. Joints:

1. The PVC line joints for below ground piping four to thirty-six inches (4"-36") in diameter shall be of the push-on type unless otherwise approved by the ENGINEER so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be a single rubber gasket joint designed to be assembled by the positioning of a continuous, molded rubber ring gasket in annular recess in the pipe or fitting socket and the forcing of the plain end of the entering pipe into the socket, thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and annular recess shall be designed and shaped so that the gasket is locked in place against displacement as the joint is assembled. The rubber ring joint shall be designed for thermal expansion or contraction with a total temperature change of at least 75°F in each joint per length of pipe. The bell shall consist of an integral wall section with a solid cross section elastomeric ring which shall meet requirements of ASTM D1869. The thickened bell section shall be designed to be at least as strong as the pipe wall. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to the water.
2. PVC joints for pipe less than two inches (2") in diameter shall be threaded or solvent welded joints where called for on the Drawings, unless otherwise approved by the ENGINEER. Teflon thread tape or liquid teflon thread lubricant shall be used on all threaded joints to serve as both a sealer and lubricant. Threaded joints should be made hand tight (hard). When the joint is hand tight a strap wrench should be used to make up one to two (1-2) additional full turns past the hand tight point. Do not use pipe wrenches or pump pliers on plastic pipe or fittings.

C. Fittings: All fittings for pressure or class-rated PVC pipe for below ground piping of three to thirty-six inches (3"-36") in diameter shall be ductile iron with mechanical joints and shall conform to AWWA/ANSI specifications C110/A21.10 or C153/A21.53 for ductile iron fittings and Section 02619 unless otherwise approved by the ENGINEER.

1. The MANUFACTURER of the pipe shall supply all polyvinyl chloride accessories as well as any adaptors and/or specials required to perform the work as shown on the drawings and specified herein. Standard double bell couplings will not be accepted where the pipe will slip completely through the coupling.

- D. **Restrained Joints:** Restrained joints and fittings for PVC pressure mains shall be EBAA Iron, Inc., Megalug Retainer Glands, Series 1600 for bell and spigot pipe (4-inch through 12-inch sizes), Series 2800 for bell and spigot pipe (14-inch through 36-inch sizes), and Series 2000 PV for mechanical joint fittings (4-inch through 36-inch sizes). After installation, apply a heavy bitumastic coating to all bolts, nuts and accessories. Romac 600 Series pipe restraining systems can be used (4-inch through 12-inch sizes). The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil as shown on the drawings. All bolts and nuts for restrained joints shall be "Corten" type, low alloy, and high strength steel.

2.2 LOCATION AIDS

- A. All nonmetallic pressure main and service line installations shall include an approved method for locating lines from the ground surface after completion
- B. **Tracer Wire:** Tracer wire for non-metallic pressure mains shall be minimum THHN insulated, solid copper wire shall be laid in the pipe trench. Color of tracer wire shall be blue, green, or purple for water, sewer, or reuse respectfully. The wire shall be continuous from valve box to valve box. All splices made along the pipe line shall also be insulated. The wire shall be wrapped two times around each valve, then extend up inside the valve box to enable a location device to be attached without digging up the valve box. The wire shall not be in contact with the pipe.
- C. **Approved Manufacturers (Tracer Wire Silicone-filled Wire Nut Connectors)**
1. Ideal Industries, Model Twister® DB Plus
 2. King Innovation, Inc., Model DryConn®.
 3. Approved Equal.

2.3 IDENTIFICATION

- A. Each length of pipe and each fitting shall be marked with the name of the MANUFACTURER, size, and class. All gaskets shall be marked with the name of the MANUFACTURER, size, and proper insertion directions. A color sample of the PVC pipe and fittings shall be submitted to the ENGINEER for approval prior to fabrication of any pipe and accessories.
- B. All below ground polyvinyl chloride pipe and fittings shall have an identification color code.
1. Potable water mains – Blue.
 2. Raw sewage force mains, gravity sewer pipe and process piping - Green.
 3. Reclaimed water and irrigation reuse mains and service piping - Purple. Marking tape color shall be red.

PART 3 - EXECUTION

3.1 INSTALLING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. All mains shall be installed in accordance with recommendations of the pipe MANUFACTURER and as specified herein.
- B. Care shall be taken in the handling, storage, and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installing, and no pipe shall be installed which is found to be defective. Pipe or fittings shall not be dropped. All damage to the pipe coatings shall be repaired according to the MANUFACTURER's recommendations.
- C. All pipe and fittings shall be kept clean and shall be thoroughly cleaned before installation.
- D. Pipe shall be laid to the lines and grades shown on the Drawings with bedding and backfill as shown on the Drawings and as specified in Section 02221. Blocking under the pipe will not be permitted.
- E. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when laid, shall conform to the lines and grades required. Polyvinyl chloride pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be constructed as required under Section 02221 "TRENCH EXCAVATION, BACKFILL, AND COMPACTION". If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner by the CONTRACTOR, at his own expense.
- F. When installation is not in progress, including lunchtime, or the potential exists for dirt or debris to enter the pipe, the open ends of the pipe shall be closed with watertight plugs or other approved means.
- G. Under no circumstances shall the pipe or accessories be dropped into the trench.
- H. All plugs, caps, bends and other locations where unbalanced forces exist shall be anchored by restrained joints. The length of pipe for which restrained joints shall be used are shown on the Drawings.
- I. In all cases where PVC pipe is installed, a detectable marking tape shall be located 18" above the top of the pipe as specified in Section 02221.
- J. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be jointed with a bell shall be beveled to conform to the manufactured spigot end.

- K. Maintain a minimum finish grade cover of 36-inches, unless otherwise approved by the ENGINEER or shown on the Drawings.

3.2 PUSH-ON JOINTS

- A. Push-on joints shall be made in accordance with the MANUFACTURER's instructions.
- B. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be laid shall then be aligned and inserted in the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

3.3 MECHANICAL JOINTS

- A. Mechanical joints shall be made in accordance with Appendix A of ANSI/AWWA C111 and the MANUFACTURER's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket with soapy water before assembly. Bolts shall be tightened to the specified torques using a calibrated torque wrench. Under no conditions shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage.

3.4 FLANGED JOINTS

- A. Flanged joints shall be installed where shown on the Drawings. Extreme care shall be exercised to ensure that there is no restraint on opposite ends of pipe or fitting which will prevent uniform gasket compression, cause unnecessary stress, bending or torsional strains to flanges or flanged fittings. Adjoining push-on joints shall not be assembled until flanged joints have been tightened. Bolts shall be tightened alternately and evenly. After installation apply a bitumastic coating to bolts and nuts.

3.5 RESTRAINED JOINTS

- A. Restrained joints shall be installed at all fittings as shown on the Drawings and specified herein. The joint assemblies shall be made in accordance with the MANUFACTURER's recommendations. After installation, apply a heavy bitumastic coating to all bolts, nuts and accessories.

3.6 SLEEVE TYPE COUPLINGS

- A. Couplings shall be installed where shown. Couplings shall not be assembled until adjoining push-on joints have been assembled. After installation, apply a heavy bitumastic coating to all bolts, nuts and accessories.

3.7 INSTALLATION OF SERVICE CONNECTIONS

- A. Install service connections in accordance with the drawings and the information presented below.
- B. Provide saddles for all service connections made to PVC and DIP piping that is 4-inches and smaller. All other diameters can be direct tapped. Install service saddles with the gaskets seated on the pipe so that zero leakage is obtained. Tighten bolts to the torque recommended by the MANUFACTURER. Retest pipe section if saddle is installed after original pressure test.
- C. Minimum spacing between connections along the length of the pipe shall be 8-inches.

3.8 TRACER WIRE

- A. Tracer wire shall be installed on all new pressure mains and service lines. The tracer wire shall be placed directly above the pipe and electrically continuous throughout the project. Tracer wire shall be secured to the pipe with PVC tape the same color as the wire insulation, at a maximum of 10-feet on center between tapings.
- B. Tracer wire shall daylight at each above-grade main or appurtenance location
- C. Splices and/or connections in the tracer wire shall be installed with silicone-filled wire nuts designed for direct burial.

3.9 TESTING (PRESSURE PIPING)

- A. All pressure mains shall be field tested. Hydrostatic pressure and leakage tests shall conform to Section 02570 and 02619.

END OF SECTION 02622

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SECTION 02640

VALVES AND ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to install valves and accessories complete, tested, and ready for use, as shown on the Drawings and/or as specified herein.

1.2 RELATED REQUIREMENTS

- A. Construction Drawings, Agreement Declarations, Exhibits and other Technical Specification Sections apply to this Section.

1.3 SUBMITTALS

- A. Submit shop drawings to the ENGINEER for review in accordance with Division 01 Section 01300 – “Submittals”.
- B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.
- C. Shop Drawings: Submit manufacturer's assembly-type (exploded view) show drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual, in accordance with requirements of Division 01.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Valve Types: Provide valves of same type by same manufacturer.

- C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.
- D. Codes and Standards:
 - 1. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by installer to comply with installation requirements. Provide end connections that properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is installer's option.
- B. Design valve operators not to require over 80 pounds pull to meet required torque to operate valves.
- C. Furnish manually operated shutoff or isolation valves, above grade, with handwheel or lever operators.
- D. Furnish manually operated shutoff or isolation valves, below grade, with AWWA 2-inch square actuating nuts and valve boxes. Provide valve boxes to consist of cast iron base and adjustable top section with cover marked "WATER" for water service, "SEWER" for wastewater applications and "RECLAIM" for reclaimed water applications. All other applications shall be blank. Provide stainless steel extension stems on the 2" square nuts to bring the stem to within 6" of grade. All extensions shall be fastened to the stem with 316 stainless steel hardware.
- E. Handle valves with care to avoid damage. Load and unload valves by lifting. Do not drop, skid or roll valves under any circumstances. Do not place valves against pipe or other fittings in such a manner that damage could result. Use padded slings, hooks, or tongs for lifting in such a manner as to prevent damage. If any part of valve coatings and linings are damaged, repair or replace in a manner satisfactory to ENGINEER before installing, and at no additional cost to OWNER. Store valves at all times in a safe manner to prevent damage and keep free of dirt, mud, or other foreign matter. Store and place valve gaskets in a cool location out of direct sunlight and out of contact with petroleum products. Use gaskets on a first-in, first-out basis.

2.2 GATE VALVES

A. All valves shall be manufactured in accordance with AWWA Standard.

1. Resilient Seated Gate Valves 14" and less
 - a. Resilient seated gate valves shall be designed and fabricated in accordance with the current AWWA Standard C509. The basic design of the gate valves shall have a cast iron body, elastomer encapsulated cast iron disc, bronze stem and operating nuts with non-rising stem design. The valve working pressure shall be 200 psig with a test pressure of 400 psig.
 - 1) Materials and Construction: Valves shall open counterclockwise with a 2-inch square cast iron operating nut secured to the valve stem by a corrosion resistant nut to threads on the valve stem. The valve stem shall be made of high tensile
2. Resilient Seated Gate Valves 16" and larger
 - a. The valve shall comply with AWWA Standard C515, latest edition. The valve shall be furnished as follows:
 - 1) Counterclockwise opening
 - 2) Maximum torque for any valve shall be less than 200 ft-lbs
 - 3) 3:1 Bevel gear ratio operator (16" through 24" valves)
 - 4) 6:1 Bevel gear ratio operator (30" and 36" valves)
 - 5) 8:1 Bevel gear ratio operator (42" and 54" valves)
 - 6) 2 ½ NPT tap on valve body to allow for flushing of wedge gate channel assembly, with 2 ½" NPT Sch. 40 type 316 stainless steel 90 degree bend and tubing as shown on the detail on the plans. The tube shall be furnished with a 2 ½" type 316 stainless steel body, full port ss ball valve with stainless steel lever and NPT ends. The end of the tube shall be furnished with a 2 ½" x 1 ½" type 316 stainless steel reducer and a 1 ½" stainless steel NPT female hose connection with a MPT end plug. (See details on project plans)
 - 7) All valve joints up to 48" shall be restrained with ACIPCO "Flex-Ring" joints or equivalent or MJ-Coupled Joint without exception. Valve joints shall meet or exceed the applicable performance and manufacturing requirements of AWWA Standards C110 or C153, latest edition
 - 8) 54" Gate Valves shall employ the use of flanged joints. 304 stainless steel flange accessories shall be used. The cost for the use of any additional fittings required to achieve additional joint deflection as a result of the flanges will be at the expense of the contractor.
3. Resilient wedge gate valves shall be manufactured by Flowmatic, Clow, Dezurik, or M&H. All supplied valves shall be by the same manufacturer.

B. All internal and external surfaces shall be coated prior to assembly with an epoxy coating in accordance with Division 9.

2.3 BUTTERFLY VALVES

- A. All butterfly valves shall be of the rubber-seated, tight-closing type. They shall meet or exceed AWWA Standard C504. All valves must use full AWWA C504 Class 150B valve shaft diameter, and full Class 150B underground service operator torque rating throughout entire travel, to provide capability for operation in emergency service.
- B. Valve Construction -Valve body shall be high-strength cast iron ASTM A126 Class B with 18-8 Type 304 stainless steel body seat. Valve vane shall be high-strength cast iron ASTM A48 Class 40, having rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel self-locked screws. Shaft shall be one piece ANSI 304 stainless steel. Bearings shall be sleeve-type, self-lubricated with O-Ring seals.
- C. Operators
 - 1. Operators shall be as shown on the drawings.
 - 2. Buried Operators shall not be used.
- D. End Connection
 - 1. End connections shall be mechanical joint and furnished as specified, wafer-type with flange meeting ANSI B16.1-125#. Flanged end connections shall conform to ANSI B16.1-125# and furnished as specified.
- E. Valves shall be painted per section 09900. Equivalent manufacturer coatings shall be approved by the Engineer.
- F. Butterfly Valves shall be as manufactured by Flowmatic, M&H Valve, Val-Matic, or Dezurik. All supplied valves shall be by the same manufacturer.

2.4 PLUG VALVES

- A. Provide plug valves suitable for flows and for buried, submerged or above grade service. Provide manually actuated straight way valves of non-lubricated eccentric type with resilient faced plugs, mechanical joint ends for buried service (ANSI A21.11), and flanged for above ground (ANSI B16.1 Class 125). Ensure port areas of all valves are at least 100% of full pipe areas.
- B. Provide valve bodies of cast iron with raised seats, with nickel seats. Plug facing shall be N.B.R. Provide upper and lower plug stem bushings of stainless steel or isolated with O-rings and permanently lubricated. Provide valves of bolted bonnet design, with V-type packing. Provide stainless steel exposed nuts, bolts, springs, and washers. Bearings shall be 316 stainless steel. Thrust bearings shall be PTFE.
- C. Plug valve pressure ratings:
 - 1. Sizes 2-inches through 12-inches: 175 psi
 - 2. Sizes 14-inches through 42-inches: 150 psi

- D. Valves capable of drip-tight shutoff up to full valve rating with pressure in either direction.
- E. Valves shall be painted per the coating sections in these specifications. Equivalent manufacturer coatings shall be approved by the Engineer.
- F. Plug valves shall be as manufactured by Dezurik Valve or approved equal. All supplied valves shall be by the same manufacturer.

2.5 AIR /VACUUM RELEASE VALVE ASSEMBLY –EXPOSED APPLICATIONS

- A. Furnish air/vacuum release valve assemblies and install in locations as indicated on the Drawings.
- B. Air release valve shall be as specified for buried application except as noted and except vault shall be omitted and isolation valve shall be a ball valve. Valve body may be stainless steel.
- C. Air/Vacuum Release Valve shall be A.R.I. D-070 or approved equal. All supplied valves shall be by the same manufacturer.

2.6 CHECK VALVES

- A. Over Three Inches: Provide check valves over three inches made of cast iron body, bronze seat ring, horizontal-swing check with flanged ends, except as specified herein. Provide tight seating valve, air-cushioned in operation, with a renewable seat ring.
- B. Provide check valve with a lever and adjustable weight attached to side of valve body externally that will effectively permit the valve to be operated without any hammering action. Arrange weight and lever so that the closing will be adjustable to meet service requirements.
- C. Provide convex valve disc of cast iron, suspended from a non-corrosive shaft that will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.
- D. Valves shall be painted per the coating sections in these specifications. Equivalent manufacturer coatings shall be approved by the Engineer.
- E. Provide check valves by GA Industries Inc. (Golden-Anderson), or approved equal.

2.7 BALL VALVES

- A. Unless specifically noted, ball valves shall be PVC top entry type as manufactured by Hayward or approved equal for 4" or smaller only.

2.8 VACUUM RELIEF VALVES

- A. Vacuum relief valves shall be sized as indicated on the drawings. The vacuum vent shall terminate above grade as indicated with stainless steel insect screening over opening. Valves may be NPT screwed inlet and outlet design or 125 lb. ANSI B16.1 flanged design. Body shall be cast iron, trim, including float, shall be stainless steel and the seal shall be BUNA-N rubber. Valve shall be sized to adequately vent line where installed with less than 2.5 psi pressure drop.

2.9 WELL SERVICE AIR VALVE

- A. Well service air valves shall be fully automatic float operated valves designed to exhaust air which is present in the pump column on pump startup and allow air to re-enter the column on pump shutdown or should a negative pressure occur.
- B. Valves shall be manufactured and tested in accordance with AWWA C512 and NSF certified for use in potable water systems.
- C. The well service air valve body, cover, and baffle shall be constructed of ASTM A126 Class B cast iron for Class 125 and Class 250 valves. The float, guide shafts, and bushings shall be constructed of Type 316 stainless steel. Non-metallic guides and bushings are not acceptable. Resilient seats shall be Buna-N.
- D. Well Service Air Valves shall be Series 100ST as manufactured by Val-Matic or approved equal

2.10 TAPPING SLEEVES AND VALVES

- A. The contractor shall perform taps on pressurized lines for the installation of pipes other than service lines of 2-inch and smaller PE tubing in accordance with these requirements:
- B. Materials
 - 1. All materials used for taps on pressurized lines shall meet the requirements of these specifications. Tapping sleeves shall be properly sized for the pipe being tapped. All other material used to accomplish the tap shall meet the standards set forth in Specification AWWA C509, latest revision, covering gate valves except as modified for passage and clearance of tapping machine cutters. All hardware shall be 316 stainless steel.
 - 2. Body Sizing
 - a. Valve body length shall be per ANSI Standard B16.1 for tapping valves. The opening through the valve shall be at least 1/4-inch larger than nominal valve diameter. Tapping valves shall allow full size shell cutters to be used.
 - 3. End Connections

- a. Valves shall be furnished with one end of the body with projecting face flange in accordance with specification MSS SP-60 for tapping valve/saddle connections to bolt to a standard tapping sleeve and the other end for mechanical joint.

PART 3 - EXECUTION

3.1 SETTING VALVES AND BOXES

- A. Install valves and valve boxes as specified in the preceding paragraphs where shown on Drawings unless otherwise directed. Set valves plumb with base of valve box centered over valve and resting on compacted backfill. Set top section of box to allow equal movement above and below finished grade. After being correctly positioned, carefully tamp fill around valve box for a distance of 4-feet on all sides of box. In paved areas, make top of cover flush with finished paving. In off-street areas, set cover 1-inch above existing grade unless otherwise directed by Engineer/Architect, and pour a concrete pad around top of box, as shown in standard details.
- B. Stainless steel extension stems shall be provided on all buried valves when the operating nut is deeper than 4 ft below final grade.

3.2 VALVE COLLARS

- A. All buried valves shall have a 4" thick square concrete collar extending a minimum eight inches around the valve. A brass valve tag shall be embedded in the collar and shall list the valve identifier number, size, type, and number of turns to full open/close.

END OF SECTION 02640

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SECTION 02850

POTABLE WATER SUPPLY WELL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The project consists of the installation and testing of one potable water supply well. The supply well will have a casing diameter of 16 inches and a minimum depth of approximately 350 feet. The total well depth will be a maximum of approximately 500 feet deep completed within the Upper Floridan Aquifer.
- B. The work site is located on property acquired by the City for the new Tank Hill Water Facility located north of St Joe Road and west of 21st Street at the western boundary of Dade City.
- C. A geotechnical investigation at the site was conducted with a temporary monitoring well installed for collection of water level data and water quality analysis. CONTRACTOR shall review investigation prior to commencing work.
- D. The work to be performed under this contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles and for furnishing all transportation and services, including fuel and essential communications, and for the performance of all labor, work, and other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents.
- E. Reference to CONTRACTOR in the section shall refer to the drilling subcontractor or both the General Contractor awarded the Contract and the drilling subcontractor.
- F. The work shall be complete, and all work, materials and services not expressly shown or called for in the Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be performed, furnished, and installed by the CONTRACTOR as though originally so specified or shown, at no increase in cost to the OWNER.

1.2 OUTLINE SPECIFICATIONS OF WELL CONSTRUCTION AND TESTING.

- A. Well Construction and Testing
 - 1. Conduct a Standard Penetration Test using Hollow Stem Auger, or other approved method, to a minimum of eighty (80) feet to classify the subsurface soils identifying the depth(s) of the surficial sands, confining layer, and top of limestone.

2. Drill twenty-four (24) inch diameter borehole to approximately twenty (20) feet below land surface (bls);
3. Install and grout twenty (20) inch diameter surface casing to a depth of twenty (20) feet;
4. Drill by mud-rotary, or other approved method, to a minimum of ten (10) feet into competent limestone;
5. Install, center and grout 16-inch diameter black carbon steel casing (estimated depth 350 ft);
6. Perform a vertical alignment test;
7. Drill a 10-inch diameter open borehole using reverse air circulation, or other approved method, to a total depth of 500 feet (estimated) or until significant cavities are encountered. During drilling and at depths of 370, 410, 450, and 490 feet, conduct specific capacity tests using an electric submersible pump with a minimum pumping capacity of 250 gallons per minute (gpm). Groundwater levels should be measured under static and pumping conditions for both the supply well and the on-site monitoring well. For the pumping conditions groundwater levels should have stabilized before terminating the test. Contractor shall provide access for the CITY personnel to collect ground water samples before, during, and/or after pumping at each testing depth;
8. Data from the specific capacity tests and laboratory analysis will be used by the ENGINEER to determine if drilling should be terminated and the total depth of the well casing;
9. Upon completion of the well drilling process, the CONTRACTOR shall clean the well and shall conduct a down-hole video survey of the completed well;
10. The CONTRACTOR shall install a temporary submersible pump capable of pumping at a rate of 500 gallons per minute (gpm). The CONTRACTOR shall conduct a six (6) hour specific capacity test. The discharge from the pump should be constructed such that no damage or harm to the environment shall occur during the test;

B. Well Disinfection

1. Disinfect wells in accordance with Part 3.
2. Disinfection of well will be repeated after installation of pump and final wellhead. FDEP drinking water section bacterial clearance will be obtained after installation of pump and wellhead.

C. Well Abandonment

1. Existing wells owned by the City and depicted on the Drawings and described herein shall be abandoned in accordance with all applicable regulations. Well abandonment shall be performed by the same certified well driller construction the new potable supply well.
2. Wells To Be Abandoned
 - a. College Heights
 - 1) Location: Roth Lane east of Happy Hill Road
 - 2) Type: Public Water Supply
 - 3) Diameter: 6-inch

- 4) Depth: 300 feet
- b. Sally Road
 - 1) Location: North end of Sally Road north of US 98
 - 2) Type: Public Water Supply
 - 3) Diameter: 4-inch
 - 4) Depth: 100 feet
- c. Tank Hill
 - 1) Location: Project Site
 - 2) Type: Monitoring
 - 3) Diameter: 4-inch
 - 4) Depth: 300 feet

1.3 QUALITY ASSURANCE

- A. All work shall be supervised by a certified water well driller. The well driller shall have all applicable state, county, and local licenses required to drill water wells.
- B. Water well driller shall demonstrate recent experience in construction of potable water supply wells of similar size, depth, use, and location. CONTRACTOR shall provide references to a minimum of six (6) projects completed within the past five (5) years as part of the bid submittal. Reference projects shall be for wells constructed for potable water use in Florida.
- C. Complete the work described in these Specifications in accordance with the applicable sections of the following:
 - 1. AWWA A100
 - 2. Chapter 62-532 F.A.C.
 - 3. Chapter 40E-3 F.A.C.
- D. AWWA and ASTM Standards
 - 1. AWWA A100-06 - Water Wells
 - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. ASTM C 150 - Standard Specification for Portland Cement

1.4 PERMITS

- A. It shall be the CONTRACTOR's responsibility to secure all permits required to initiate and complete the Work under this Section, except for permits obtained by the OWNER listed herein. Anticipated permits to be obtained by CONTRACTOR include the following:
 - 1. Well Construction Permit
 - 2. Well Completion Report
- B. Permits obtained by the OWNER include the following:

1. SWFWMD Water Use Permit (#1631) authorizing withdrawal of groundwater.
2. FDEP Application to Construct Potable Water System Components

1.5 SUBSURFACE CONDITIONS

- A. The CONTRACTOR acknowledges that he has investigated prior to bidding and satisfied himself as to the conditions affecting the Work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, tides, water tables, or similar conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the Work. The CONTRACTOR further acknowledges that he has satisfied himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, or any contiguous site, as well as from information presented by the Drawings and Specifications made a part of this Contract, or any other information made available to him prior to receipt of bids.
- B. Any failure by the CONTRACTOR to acquaint himself with the available information will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the Work. The OWNER assumes no responsibility for any conclusions or interpretations made by the CONTRACTOR on the basis of the information made available to the OWNER.

1.6 SUBMITTALS

- A. Within 14 days of receiving notice to proceed, the CONTRACTOR shall submit, in writing, the following:
 1. A complete list of construction materials and supplies including the name of the manufacturer, for the items listed below:
 - a. Casings.
 - b. Grout.
 - c. Drilling fluid additives.
 2. Drilling fluid and cuttings disposal location.
 3. Safety plan.
- B. During drilling of each well, a detailed daily driller's report shall be maintained and submitted as requested by the ENGINEER. The report shall give a complete description of all formations encountered, number of feet drilled, number of hours on the job, shutdown due to breakdown, feet of casing set, and other pertinent data requested by the ENGINEER.
- C. During drilling (except cored intervals) of each borehole, formation samples shall be collected at ten (10) foot intervals and at changes in lithology, and preserved immediately

after retrieval in a manner approved by the ENGINEER. Samples shall be clearly and indelibly labeled with the following information:

1. Location of the well.
2. Name or number of the well.
3. Sample number.
4. Depth interval represented by the sample.
5. Date taken.
6. Time taken.

1.7 CONTRACTOR AND SUBCONTRACTOR REQUIREMENTS

- A. Furnish equipment in first class working order. Use own drilling equipment having the minimum capabilities necessary to do the described work.
- B. Furnish and operate equipment capable of handling the largest load that will be placed upon the drilling rig during the construction.
- C. Be required to furnish a larger drilling rig with the necessary capacity if conditions develop in the field that prove the rig supplied is incapable of completing the well.
- D. Be held responsible and payment withheld for damages to the well or other property due to any cause of negligence, faulty operation, or equipment failure.
- E. Storage and Construction Areas
 1. Storage areas shall be provided by the OWNER within the designated construction and staging area.
 2. Responsibility for protection and safekeeping of equipment and materials at or near the sites will be solely that of the CONTRACTOR and no claim shall be made against the OWNER by reasons of any act of an employee or trespasser.
 3. The CONTRACTOR should coordinate with the OWNER in selection of storage areas not likely to impede other activities on the site. Should an occasion arise necessitating access to an area occupied by stored equipment and/or materials, the CONTRACTOR shall immediately move the stored material.
 4. No equipment or materials shall be placed upon the OWNER's property until approval has been received from the OWNER.
 5. Upon completion of the Contract, the CONTRACTOR shall remove from the storage areas all of their equipment, temporary fencing, surplus materials, rubbish, etc., and restore the area as designated by the ENGINEER.
- F. Drilling fluid and cuttings disposal
 1. The CONTRACTOR shall be responsible for proper and legal disposal of all drilling fluids and cuttings produced during drilling and well development. The disposal location of the fluids is subject to the review and approval of the ENGINEER, OWNER, and regulatory authorities. The disposal location shall be submitted to the ENGINEER in writing before the start of construction.

- G. The CONTRACTOR shall employ only competent workmen for the execution of this work and all such work shall be performed under the direct supervision of an experienced well driller. The crew shall be in the employ of the CONTRACTOR.

1.8 NOTIFICATION

- A. The CONTRACTOR shall supply to the ENGINEER, in writing, the proposed work schedule, including the following:
 - 1. The starting date of the well construction.
 - 2. The completion date of the well construction.
 - 3. Any anticipated work stoppages of duration greater than 24 hours with exception of weekends and holidays.
- B. Any change in the number of rigs and personnel shall require written notification to the ENGINEER, 72 hours prior to the change.
- C. Notify the ENGINEER, in writing, ten (10) days prior to the commencement of any drilling activities.
- D. Notify the ENGINEER 48 hours prior to the start of any testing activities.
- E. No work shall be performed by the CONTRACTOR without completing the notification requirements specified above.

1.9 WORK HOURS

- A. The normal work hours shall be from 7:00 A.M. to 7:00 P.M., Monday through Friday. Drilling equipment may not be operated before 8:00 A.M. Extended drilling hours and work on weekends are subject to the approval of the OWNER and/or ENGINEER. Extended drilling hours and work on weekends will not be allowed if there are complaints from neighbors or are disallowed by regulatory agencies or the OWNER. The CONTRACTOR shall make all reasonable efforts to minimize disturbances to neighbors.

1.10 WELL ACCEPTANCE CRITERIA

- A. All casing installed shall be plumb and true to line. Tolerance for plumbness shall be in accordance with the following accepted standards, whichever is stricter.
 - 1. Maximum allowable horizontal drift of 0.0067 times the inside well diameter per foot of depth [AWWA Standard for Water Wells (A100)].
 - 2. Maximum plumbness allowance of 6 inches per 100 feet of well depth [Standard detailed in the Handbook of Ground Water Development (Roscoe Moss Company, 1990)].

- B. All well construction specifications (casing, screens, grout, gravel packs, bridge plugs, sand caps, etc.) shall be set to the depths directed by the ENGINEER. Alternative depths suggested by the CONTRACTOR because of alignment, equipment problems or failure to set the casing to the depth selected by the ENGINEER shall be approved by the ENGINEER.
- C. The water supply well shall satisfy the FDEP construction permit, the rules of Chapter 62-532 (F.A.C.), and approved modifications to the FDEP well construction permit.
- D. No payment for the well will be due if the CONTRACTOR fails to meet all of the above requirements.

1.11 REMEDIAL WORK

- A. If remedial work proves to be necessary to make a well acceptable and come within the governing regulations and/or Contract Documents because of accident, loss of tools, defective material or for any other cause, the CONTRACTOR shall propose a method of correcting the problem, in writing. Suggested methods shall be reviewed and accepted by the ENGINEER before work proceeds. Such work shall be performed at no additional cost to the OWNER and it shall not extend the length of the Contract. The CONTRACTOR is notified that all requirements of the Contract Documents shall be met, including hole straightness and setting of casings to the points designated by the ENGINEER.

1.12 ABANDONMENT OF WELL BY CONTRACTOR

- A. Any hole in which the CONTRACTOR voluntarily stops work and/or fails to complete in a satisfactory manner, in accordance with the governing regulations and/or Contract Documents shall be considered as abandoned. If the OWNER declares the hole abandoned by the CONTRACTOR, then no payment will be made for the abandoned hole.
- B. All abandoned holes shall be properly plugged and sealed by the CONTRACTOR at his own cost in accordance with federal, state and local regulations. All salvageable material furnished by the CONTRACTOR may be removed and remain the property of the CONTRACTOR. The CONTRACTOR shall submit, in writing, his plan for action of abandonment and plugging. Casings may be removed only with the permission and acceptance of the ENGINEER.

1.13 GUARANTEE

- A. The CONTRACTOR guarantees that the work and services to be performed under this Contract and all workmanship, materials, and equipment performed, furnished, used, or installed in the Work shall be free from defects and flaws, and shall be performed and

furnished in strict accordance with the Contract Documents; that the strength of all parts and all manufactured equipment shall be adequate and as specified; and that performance test requirements of the Contract Documents shall be fulfilled. The CONTRACTOR shall guarantee that all work will be performed in a workmanlike manner by qualified well drillers experienced in the type of formations to be encountered. The CONTRACTOR shall repair, correct, or replace all damage to the work resulting from failures covered by this guarantee at his expense. This guarantee shall remain in effect for two years from the date of final acceptance by the OWNER.

PART 2 - PRODUCTS

2.1 WELL CASINGS

A. Surface Casing

1. The surface casing shall be nominal 20-inch diameter, new, unused, random length, steel casing with a 0.375-inch minimum wall thickness, and shall conform to either API 5L Grade B, ASTM A 53 Grade B or Spiral Weld A 139 Grade B.
2. The casing shall be plain end and beveled for welding and shall be joined together by certified welders.

B. Well Casing

1. The well casing shall be nominal 16-inch diameter, new, unused, random length, steel casing with a 0.307-inch minimum wall thickness, and shall conform to either API 5L Grade B, ASTM A 53 Grade B or Spiral Weld A 139 Grade B.
2. The casing shall be plain end and beveled for welding and shall be joined together by certified welders.
3. The casings shall be butt welded and squared for vertical alignment.
4. The casing shall be tested and certified to ANSI/NSF Standard 61 and classified under ASTM D2996 as Type 1, Grade 2, Class A.

2.2 GROUT INFORMATION

- A. The CONTRACTOR shall provide all grout, materials, collarless tremie pipe specifications, and equipment necessary for placement of the grout as specified.
- B. The grout mixture shall consist of Portland Cement, conforming to ASTM C 150, Type II. The mixture shall consist of 5.2 to 5.5 gallons of water per sack of Portland Cement.
- C. The CONTRACTOR shall not provide other cementing additives formulated specifically for well cementing without ENGINEER approval. Use of bentonite grout is not allowed.

2.3 WATER

- A. All water used during construction of the well shall be of potable water quality. Potable water shall be provided by the OWNER.
- B. OWNER may provide a temporary flowmeter to monitor water use during construction.

2.4 VIDEO SURVEY CAMERA

- A. The camera used for the survey shall be equipped with vertical- and side-view cameras and with centralizers. The equipment used to complete the video survey shall produce a tape with an automatic depth indication (to the nearest 0.1 feet).

2.5 WELLHEADS

- A. The Driller shall coordinate termination of the well casing with the CONTRACTOR for construction of the wellhead. The Driller shall provide a temporary, water-tight cover (steel cap or welded flange adapter and blind flange) to protect well during construction.
- B. Wellhead shall terminate above land surface at the final wellhead elevation shown on the Drawings.

PART 3 - EXECUTION

3.1 EQUIPMENT

- A. The CONTRACTOR shall provide all necessary equipment to perform the specified work. The CONTRACTOR's and/or his SUBCONTRACTOR's equipment shall be in first class working order and shall be suitable for completing the work described herein. No unnecessary delays or work stoppages will be tolerated because of equipment failure. They will not be considered a valid reason for extending the length of the Contract. The CONTRACTOR shall be held responsible and payment may be withheld for damages to a well due to any cause of negligence, faulty operation, or equipment failure.
- B. The CONTRACTOR shall provide and operate equipment capable of handling the largest load that will be placed upon the rigs drilling and supporting equipment. If conditions develop in the field that prove the rigs and supporting equipment that had been supplied by the CONTRACTOR are incapable of completing a well, the CONTRACTOR shall provide a larger rig with the necessary capacity at his own cost.
- C. The CONTRACTOR's and/or his SUBCONTRACTOR's equipment shall be operated and maintained in conformance with manufacturers recommendations.

- D. The CONTRACTOR shall provide all drilling fluids, water, and additives required for drilling. All fluids and additives shall comply with federal, state and local regulations. Only drilling fluids and additives shall be used that are specifically recommended by the manufacturer for use in water well drilling. The CONTRACTOR shall be responsible for preventing contamination of the samples and/or the aquifer. The CONTRACTOR shall review fluids and additives with the ENGINEER prior to drilling.

3.2 DRILLING

- A. A portable mud pit shall be used during mud-rotary drilling. An excavated or bermed mud pit shall not be used.
- B. When all casings are being set and cemented in place, it is the CONTRACTOR's responsibility to insure that these operations are conducted in such a manner that the casing collapse and burst strengths (with safety factor) are not exceeded and the casings are not caused to fail.
- C. The CONTRACTOR shall provide a thoroughly experienced, competent, and licensed driller satisfactory to the ENGINEER who shall be present on site during all drilling operations.
- D. Wells are to be of the general type and characteristics described in the Contract Documents. The exact depth of well and length of casings will be determined in the field based on data collected.
- E. All boreholes other than for the pit pipe shall be drilled using either the mud-rotary or reverse-air circulatory methods. The mud-rotary shall be used for drilling the boreholes for the surface casings. All borehole below the surface casing shall be drilled using the reverse-air circulatory method.
- F. The CONTRACTOR shall drill the wells at the approximate location shown on the Drawing. The exact location will be determined in the field by the ENGINEER.
- G. The CONTRACTOR shall drill the borehole to permit the installation of the casing straight and plumb.
- H. A caliper log shall be run on the final borehole prior to well installation to confirm uniform diameter and precise annular volume. The caliper log shall be coordinated with the Engineer.
- I. Priority requirements of these Technical Specifications is the drilling of straight holes. The completed wells shall be sufficiently plumb and straight so that there will be no interference with the installation, alignment, operation or future removal of a permanent well pump.

- J. If the ENGINEER determines the well fails the plumbness and alignment test, the CONTRACTOR may test the plumbness and alignment, in the presence of the ENGINEER, by lowering a section of pipe 120 feet long or a dummy of the specified pump length. The outer diameter of the test pipe or dummy shall not be more than 1/2-inch smaller than the inside diameter of the casing to be tested.
- K. If the well fails the plumbness and alignment test, the well shall be repaired as directed by the ENGINEER. If in the opinion of the ENGINEER, the well cannot be repaired, then the well shall be plugged as per current state requirement and a new well shall be constructed at the CONTRACTOR'S expense.

3.3 FORMATION SAMPLE DATA COLLECTION

- A. The CONTRACTOR shall not be responsible for the collection of formation samples. However, the ENGINEER may collect formation samples during drilling activities. In order to collect representative samples, the ENGINEER may require the CONTRACTOR to periodically clear the hole of cuttings.
- B. Each sample shall be approximately one pint in volume, and placed in a container labeled using indelible ink with the date, well identification and depth from which the sample was taken. Two sets of samples shall be collected from ground surface to the total depth of the well every ten feet or formation change.

3.4 CASING INSTALLATION

- A. The CONTRACTOR shall install casing to the approximate depths as shown in the Contract Drawings, or as instructed by the ENGINEER.
- B. The CONTRACTOR shall install the casing such that all joints are water tight. The method used to connect casing lengths shall be in accordance with the manufacturer's recommendations so that the resulting joint shall have the same structural integrity as the casing itself.
- C. The CONTRACTOR shall remove and replace all casing which fails, collapses, or separates during construction at his sole expense.

3.5 CASING CENTRALIZERS

- A. The CONTRACTOR shall provide all fittings, drive shoes and centering guides necessary to complete the well as designed.
- B. All casing centralizers shall be manufactured by a company acceptable to the ENGINEER. The CONTRACTOR may propose fabrication of centralizers in the field, provided they are acceptable to the ENGINEER.

- C. Casing centralizers shall be installed at the approximate locations shown below:
 - 1. 20 feet above bottom of casing
 - 2. 40 feet above bottom of casing
 - 3. 100 feet above bottom of casing
 - 4. At 100-foot intervals thereafter up to 100 feet from ground surface
- D. Alternative centralizer locations may be used with prior approval from the ENGINEER based on results of a caliper log.
- E. Casing centralizers shall be installed at 0, 90, 180, and 270 degrees around the casing at each position and shall be in a precise vertical alignment, one above the other, to allow for placement of tremie pipes in the annulus.

3.6 GROUTING PROCEDURES

- A. General: Grouting (cementing) shall be completed by a driller that is expert in well cementing.
- B. Grouting of the annular space shall be completed using a tremie pipe, forced pressure, or other equivalent method approved by the ENGINEER. Grout shall be introduced into the annular space from bottom to top.
- C. Cementing procedures shall be continuous for each stage after cementing begins. If loss of circulation or no return of cement is encountered, the ENGINEER shall be notified immediately of what remedial measures are underway to reestablish the circulation and complete the cementing program.
- D. Grout Curing
 - 1. The CONTRACTOR shall allow a minimum grout curing time of 12 hours between each grout stage.
 - 2. The CONTRACTOR shall not perform any work or any drilling operations until the grout has cured.
- E. If good bonding between casing, cement, and formation is not obtained, or there is suggestion of significant gaps in the cement, remedial work shall be done to the satisfaction of the ENGINEER. In addition, the ENGINEER may require temperature or cement bond logs to substantiate the effectiveness of any remedial grout work done. These operations shall be performed at the CONTRACTOR's expense.
- F. When the casings are being set and cemented in place, it is the CONTRACTOR's responsibility to insure that these operations are conducted in such a manner that the casing collapse and burst strengths (with safety factor) are not exceeded and the casing is not caused to fail. Cement shall be pumped or placed so that excessive pressures will not result and affect the bond.

3.7 WATER SAMPLE DATA COLLECTION

- A. Water samples will be collected by the either laboratory personnel or properly trained representatives of the OWNER using containers provided by the laboratory. FDEP sampling requirements shall be followed. The CONTRACTOR or WELL DRILLER shall provide a pump and temporary power for sample collection.
- B. All water samples will be transported or shipped to the laboratory immediately upon collection. EPA method sampling protocols (e.g. holding times, preservatives) shall be followed. Standard laboratory turnaround times are acceptable unless otherwise requested below.
- C. Water samples shall be collected from the completed well and analyzed for Florida primary and secondary drinking water standards (F.A.C. 62-550.310 & 62.550.320).

3.8 REGULATORY COMPLIANCE

- A. The CONTRACTOR shall construct the well in conformance with the FDEP construction permit and all laws, rules, regulations, and standards related to the construction of wells in the United States, State of Florida, Southwest Florida Water Management District, and any other applicable regulations.
- B. The CONTRACTOR shall take all necessary precautions to prevent contaminated water, gasoline, or other deleterious substances from entering the well, either through the opening or by seepage through the ground surface. Maintain precautions during and after construction of the well until accepted by the OWNER.
- C. The CONTRACTOR shall be responsible for disposal of all fluids produced during drilling, pumping tests and well development. The disposal location of the fluids is subject to the review and approval of the ENGINEER. The disposal location shall be submitted to the ENGINEER in writing before the start of construction.

3.9 VIDEO SURVEY

- A. The downhole color video camera survey shall be completed over the full depth of the well. The survey shall be conducted (1) after all sediment accumulating in the well from test pumping has been removed, (2) after fresh water has been introduced from the surface to clarify water standing in the well, and (3) before final disinfection of the well. Video survey results will serve as a final inspection document for the well. The survey shall be conducted by a firm retained by the CONTRACTOR and approved by the ENGINEER.
- B. The video survey shall be conducted before final disinfection of the well.
- C. Prior to conducting the survey, the test pump shall be pulled, the well bailed clean of lubricating oil, sediment and debris, and allowed to remain idle for at least 24 hours.

- D. Prior to conducting the survey, the CONTRACTOR shall introduce clear water into the well for a sufficient period and at sufficient quantity to produce clear viewing conditions during the survey to the satisfaction of the District. Should the survey fail to produce a clear picture of the internal casing conditions, additional clear water shall be introduced and additional surveys conducted until a clear video is obtained to the satisfaction of the ENGINEER. All such remedial work and re-surveys shall be conducted at the CONTRACTOR's expense.
- E. The CONTRACTOR shall provide whatever assistance may be required to accomplish the camera survey and shall take whatever steps are necessary to ensure the well water clarity is adequate to produce acceptably clear video images of internal casing conditions.
- F. The survey shall become the property of the OWNER at the time the survey is completed.

3.10 DISINFECTION

- A. General
 - 1. The CONTRACTOR shall provide all equipment, materials and testing apparatus required to perform disinfection in accordance with AWWA C651, or as modified herein.
 - 2. The video survey shall be conducted before disinfection of the well
- B. Procedure
 - 1. The CONTRACTOR shall disinfect the well using a chlorine solution, of such volume and strength and shall be so applied that a concentration of at least 50 ppm of free available chlorine shall be obtained at all times. The disinfecting agent shall be placed in the well through a hose or tremie of sufficient length to extend to the bottom of the well. The disinfecting agent shall be applied through the hose, which is to be raised and lowered, to achieve uniform distribution of the solution throughout the well. After a minimum contact period of 24 hours, the wells will be pumped sufficiently to clear it of the disinfecting agent.
 - 2. Upon completion of the well purging, the ENGINEER or OWNER shall collect samples for bacteriological analysis. The CONTRACTOR shall repeat the disinfection of any well that fails bacterial clearance.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

- E. Samples: For waterstops and vapor retarder.
- F. Qualification Data: For Installer, manufacturer and testing agency.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- H. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor retarders.
 - 10. Semi-rigid joint filler.
 - 11. Repair materials.
- I. Field quality-control test reports.
- J. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces where legs of wire bar supports contact forms, use CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 2. Blended Hydraulic Cement: ASTM C 595, Type IS, Portland blast-furnace slag cement.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. NOTE: USE OF CHEMICAL ADMIXTURES AS LISTED BELOW ARE AT THE DISCRETION OF THE CONTRACTOR AND IS TO BE EMPLOYED FOR WORKABILITY OF CONCRETE PLACEMENT.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Available Products:
 - a. Fortifiber Corporation; Moistop Ultra A.
 - b. Raven Industries Inc.; Vapor Block 15.
 - c. Reef Industries, Inc.; Griffolyn Type- 105.

2.8 FLOOR AND SLAB TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Available Products:
 - a. Burke by Edoco; Titan Hard.
 - b. ChemMasters; Chemisil Plus.
 - c. ChemTec International; ChemTec One.
 - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
 - e. Curecrete Distribution Inc.; Ashford Formula.
 - f. Dayton Superior Corporation; Day-Chem Sure Hard.
 - g. Euclid Chemical Company (The); Euco Diamond Hard.

- h. Kaufman Products, Inc.; SureHard.
- i. L&M Construction Chemicals, Inc.; Seal Hard.
- j. Meadows, W. R., Inc.; Liqui-Hard.
- k. Metalcrete Industries; Floorsaver.
- l. Nox-Crete Products Group, Kinsman Corporation; Duranox.
- m. Symons Corporation, a Dayton Superior Company; Buff Hard.
- n. US Mix Products Company; US Spec Industraseal.
- o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

2.9 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd...
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-faced material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.

- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and re-shore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Granular Course: Place vapor retarder over granular fill which has been moistened, and compacted with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch. Refer to construction details for geotextile fabric placement over granular course if indicated.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints in other slabs-on-grade, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 - 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless it is directly supervised and recorded by the Ready Mix Manufacturer Quality Control Director or Technician. Addition of water is at the responsibility of the Manufacturer and the General Contractor and will be documented.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 - 4. USE MECHANICAL VIBRATING EQUIPMENT ON THE EXTERIOR OF ALL FORMWORK TO ASSURE CONSOLIDATION OF CONCRETE AT THE FORMED FACE.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view, specifically to the outside edges of foundations only.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to all formed vertical and formed horizontal concrete surfaces.
 2. Apply to concrete surfaces to be covered with a coating or covering material applied directly to concrete.

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

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to all floor slabs except those specifically shown or scheduled otherwise.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8 inch
- C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1 by the following method:
 - 1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner at the completion of primary structural building construction and prior to installation of moisture damaged construction items.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.17 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing agency to perform tests and to submit reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION 03300

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SECTION 05120
STRUCTURAL STEEL

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 the following:
 - 1. Structural steel.
 - 2. Grout
- B. Related Sections include the following:
 - 1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.
 - 3. Division 9 painting Sections.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections
 - 1. Provide connections as shown or noted on drawings. The design of connections not shown or noted shall be provided by the Structural Engineer-of-Record upon request.
 - 2. Alternate connections designed by the Contractor's Engineer may be submitted with one set of stamped calculations for record. All alternate connections shall be designed for the value noted on plan. The Contractor shall compensate the

Structural Engineer-of-Record for time spent reviewing alternate connection designs and revising Contract Documents.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
- C. Erection Drawings:
 - 1. Submit erection drawings defining location of each assembly or piece within the structure. Provide sufficient details to describe all field welding. Clearly identify all high strength bolts not required to be tensioned (“snug tight” as defined by AISC). If drawings are submitted in multiple packages, each submittal shall be complete with all erection drawings, details and piece drawings. Subsequent submittals of erection drawings which modify or add to earlier versions will be clearly marked.
 - 2. Submit setting drawings for bolts and plates installed by others.
 - 3. Reproduction of the Contract Documents is not permitted. Electronic CAD files will not be made available to the Contractor upon request. Contractor shall agree to verify the accuracy of all such files in writing and pay a license fee for any files received.
- D. Welding certificates.
- E. Qualification Data: For Installer fabricator.
- F. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Direct-tension indicators.
 - 4. Tension-control, high-strength bolt-nut-washer assemblies.
 - 5. Shear stud connectors.
 - 6. Shop primers.
 - 7. Nonshrink grout.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category SBD.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
 - 1. The sequence of welding shall be planned to minimize locked in stresses and distortion.
- E. Fabrication and erection shall Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges", "Latest Edition", as amended below.
 - a. Section 3.1: Revise the second paragraph to read: "The Contract Documents shall clearly show the work that is to be performed and shall give the following information with sufficient dimensions to accurately convey the quantity and nature of the structural steel to be fabricated".
 - b. Section 3.2: Replace the entire section with the following: "Requirements for structural steel including dimensions, arrangement, and details shall be shown in the overall contract document package. Fabricator shall be responsible for incorporating all such information from structural, architectural, mechanical, electrical drawings, as well as those of other disciplines".
 - c. Section 3.5: Delete all text after the first sentence.
 - d. Section 3.6: Page 19, Replace the text of the entire section with the following: "When the fast-track project delivery system is selected, release of structural drawings shall constitute release for construction only, if specifically noted on the drawing. Drawings that indicate "not for construction" shall not be used for detailing".
 - e. Section 4.2: Page 21, 2nd Paragraph; Eliminate the following: "When requested to do so by the Owner's Designated Representative for Design".
 - f. Section 4.4: Page 23; Revise 2nd sentence to read the following: "These drawings shall be returned in accordance with the schedule defined in Division 1 of the project specification. In the absence of this requirement, the Owner's Designated Representative for Design shall return submittals within

14 days of receipt from the Owner's Designated Representative for Design for Construction".

- g. Section 6.4.4: Page 33; Revise statement "For the purpose of inspection, camber shall be measured in the fabricator's shop in the unstressed condition", to read "camber specified on the drawings is intended to be camber at the time of erection with decking placed prior to placing concrete. Owner's Designated Representative for Construction shall submit methods for controlling deflections on beams with inadequate camber prior to placing concrete on deck".

- 2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
- 3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design Load and Resistance Factor Design Specification for Structural Steel Buildings."
- 4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
- 5. AISC's "Specification for Allowable Stress Design of Single-Angle Members and Specification for Load and Resistance Factor Design of Single-Angle Members."
- 6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M unless noted otherwise.

1. ASTM shapes with flange thickness exceeding 2 inches, and other shapes noted in the drawings, shall be supplied with Charpy V-Notch testing in accordance with ASTM A6, supplementary requirement S30.
- B. Channels, Angles: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M - unless noted otherwise.
 1. Plates exceeding 2" in thickness shall be of steel supplied with Charpy V-Notch testing in accordance with ASTM A6, supplementary requirements S5. The impact test shall be conducted by the producer in accordance with ASTM A673, Frequency P, and shall meet a minimum average value of 20 ft. lbs. absorbed energy at +70 degrees F.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 1. Weight Class: As noted.
 2. Finish: Black, except where indicated to be galvanized.
- F. Welding Electrodes: Comply with AWS D1.1 requirements, 70 Series.
 1. Welding electrodes for complete joint penetration groove welds and welded tension splices as noted on the drawings, shall be supplied with Charpy V-Notch testing toughness of 20 ft - 1lbs at 40°F.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Use Tension control bolts whenever possible.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 1. Finish: Plain.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 1. Finish: Plain.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable.
 1. Configuration: Hooked.
 2. Nuts: ASTM A 563 heavy hex carbon steel.

3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain.

E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

G. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon low carbon steel.

H. Expansion Anchors: Wedge type with current ICBO approval and published ICBO Research Report. Completed with required nuts, washers, and Manufacturer's installation instructions. Size and Manufacturer as indicated on drawings.

2.3 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time. 6000 psf minimum.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Where grout is exposed to view or weathering, 6000 psi.

2.4 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
 1. Camber structural-steel members where indicated.
 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.

3. Mark and match-mark materials for field assembly.
 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
 2. Beam Copes and Weld Access Holes: Thermally cut surfaces in material exceeding 1-1/2" thickness in rolled and built up shapes shall be ground to bright metal in accordance with Section J.18 of the AISC specification.
- D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- H. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
- I. Splices: Splicing of members to obtain the required lengths will not be permitted without prior acceptance of the Structural Engineer-of-Record unless shown on the drawings.
- J. Substitutions: Where exact sizes and weights called for are not readily available, secure the Structural Engineer-of-Record's acceptance of suitable sizes in time to prevent delay due to such substitutions.

2.5 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: As noted on drawings.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.6 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
 - 2. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning." Where exposed to view.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

- D. Painting: Apply a 1-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.7 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection Shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures: :
 - 1. Liquid Penetrant Inspection: ASTM E 165
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164. For all complete and partial penetration groove welded connections and splices.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.
 - 2. Contractor shall coordinate installation of all non-structural steel items which will load the non-self supporting structural steel frame. The structural steel frame temporary supports shall resist all loads from these non-structural steel items.
 - 3. Field Modification: Obtain written acceptance from the Structural Engineer-of-Record before the use of flame cutting for field modification or refabrication of structural steel. The Structural Steel Fabricator shall be responsible for errors in fabrication and for correct fit in the field.
 - 4. Support of Other Work: No permanent loading other than the weight of supported metal deck and concrete slabs shall be imposed on composite beams and girders without prior approval by the Structural Engineer-of-Record until the concrete in such slabs has achieved 75 percent of its design strength. Contractor shall submit calculations prepared by an Engineer registered in the state of the project verifying the adequacy of the non-composite members to support the anticipated loading prior to developing composite strength. All costs associated with the accommodation of such loading, including review of submittals and modification of structural members and/or details, shall be borne by the Contractor.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to

cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts. Clean and moisten surfaces to be grouted. Remove all free water immediately prior to placing grout. Mix and install grout in accordance with Manufacturer's instructions. Completely fill all spaces to be grouted. After grout has acquired its initial set, trim to lower edge of bearing plate and remove excess material. Consolidate exposed edges to a dense uniform surface.

- C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- J. Compression Splices: Fasten splices in compression after bearing surfaces have been brought into contact. Clean bearing surfaces before assembling. Close all gaps 1/32" wide or greater by driving non-tapered mild steel shims full depth of the bearing surface along the full length of the gap.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: As noted on the drawings.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
- C. Drilled-In Inserts: Install in accordance with Manufacturer's recommendations in accurately drilled holes of required diameter and depth. Where adhesive inserts are used, thoroughly clean hole of all debris and drill dust by wire brushing and compressed air prior to installation of insert and adhesive system. Do not drill holes in concrete or masonry until material has achieved full design strength.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds, and high-strength bolted connections and drilled-in inserts.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
1. Visually inspect all bolted connections to ascertain that all bolts, nuts and required washers have been installed and are of proper type and that all faying surfaces have been brought into snug contact. Verify the specified surface preparation of the faying surface has been correctly prepared.
 2. Tensioned High Strength Bolts:
 - a. Standard Bolts:
 - 1) Inspect the bolt tightness of 10% of the bolts (minimum of 2), selected at random in each high strength bolted connection. If rejectable bolts are found in any connection, all remaining bolts in that connection shall be inspected for tightness. Inspection procedure shall be in accordance with "Specification for Structural Joints Using ASTM A325 or A490

Bolts” approved by Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (Research Council on Structural Connections, latest edition.

b. Twist Off (Self-Indicating) Bolts

- 1) Perform a visual inspection of all high strength bolted connections to assure that all torque-off splines have been sheared.
- 2) When splines are not sheared, the Testing Agency shall determine that proper bolt tension has been achieved by the application of a properly calibrated testing torque or the Contractor may, at his option, remove and replace all bolts with unsheared splines. All cost of additional inspection required by this paragraph shall be borne by the Contractor.

C. Welded Connections: Field welds will be tested according to AWS D1.1 and the following inspection procedures:

1. Ascertainment that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements herein.
1. Ascertainment that the welding is performed only by welding operators and welders who are properly certified. The Testing Agency shall witness such qualification testing of welding operator and welders, as may be required.
2. Ascertainment that the fit-up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements and the Contract Drawings, and that no specified welds are omitted or unspecified welds added without approval of the Structural Engineer-of Record.
3. The Testing Agency shall test field welds as follows:
 - a. All studs shall be acoustically inspected. Studs which do not ring when struck with a hammer shall be bent 15 degrees. If the bent stud does not fracture, stud is acceptable and may be left bent.
 - b. In addition to the above, not less than one of each 100 studs shall be tested by bending 15 degrees. If no fracture occurs, stud is considered acceptable and left bent.
4. If defective welds are discovered, the remaining uninspected welds shall receive such ultrasonic or magnetic particle inspection as may be required by the Structural Engineer-of-Record. All cost of additional inspection required by this paragraph shall be borne by the Contractor.
5. The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his opinion the weldment would not pass a more detailed investigation.
6. Reports by the Testing Agency’s Inspector will contain, as a minimum, an adequate description of each weld tested, the identifying mark of the welder responsible for the weld, critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current

A.W.S. standards. Reports shall be distributed as early as possible but not later than one workweek after the tests have been performed. The Structural Engineer-of-Record shall be notified by phone if, in the judgment of the Inspector, test results require immediate comment.

7. Radio graphic testing may be substituted for ultrasonic.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

F. Drilled-in Anchors:

1. Self-Expanding Anchors: The Testing Agency shall inspect self-expanding Drilled-in Anchors shown on the structural drawings as follows:

- a. Prior to installation, the Testing Agency shall determine that the installing contractor has the proper materials and equipment for drilling holes in the receiving surface of required diameter and length.
- b. All anchors shall be visually inspected after installation to ensure that they have been installed perpendicular to the receiving surface and to proper depth.
- c. Pull test the first 3 and 1% of all remaining anchors for a tension load of 100% of the Manufacturer's recommended allowable working loads in tension.

G. Verification of Erection Tolerances:

1. The contractor shall survey the structure after erection and prior to placing deck.
 - a. Submit report to the Architect and Owner within 24 hours after recording the data. Report shall identify all deviations of member locations and/or elevations in excess of allowable tolerance specified.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05120

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SECTION 09961

PAINTING FOR WATER AND WASTEWATER FACILITIES

PART 1 - GENERAL

1.1 SCOPE

- A. This section includes surface preparation, painting, and finishing of exposed interior and exterior coating systems for water and wastewater mechanical and electrical components including, but not limited to, the following:
 - 1. Piping, pipe hangers, and supports.
 - 2. Valves and fittings.
 - 3. Motors and mechanical equipment not factory painted.
 - 4. Accessory items.
 - 5. Conduit and fittings.
- B. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - 1. Pre-finished items not to be painted include the following factory finished components:
 - a. Finished mechanical and electrical equipment unless noted otherwise.
 - b. Light fixtures.
 - c. Switchgear.
 - d. Distribution cabinets.
 - e. Fire-extinguishers and mounting hardware.
 - f. Aluminum doors and frames.
 - 2. Finished metal surfaces not to be painted include:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Bronze.
 - f. Brass.
 - g. Galvalume.
 - 3. Operating parts not to be painted include moving parts of operating equipment, such as the following:
 - a. Valve- and damper-operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 - 4. Labels: Do not paint over Underwriters Laboratories', Factory Mutual or other code required identification plates or equipment name, identification, performance

rating, or nomenclature plates. If such required labels are in the form of stickers rather than metal plates, such stickers shall be removed prior to painting and replaced with new matching stickers after acceptance of the finish by the Owner.

1.2 COLOR SELECTION

- A. All exposed pipe and fittings shall be painted as follows:
 - 1. Potable water: Blue.
 - 2. Wastewater: Green
 - 3. Reclaimed Water: Purple (Pantone 522C)
- B. All exposed pipe and fittings not included in previous subsection shall be painted with colors as selected by the Owner from the manufacturer's standard color chart.
- C. All exposed pipe shall be painted with a flow directional arrow at a maximum spacing of every 10 feet in plain view in a contrasting color to the underlying pipe or paint color.

1.3 RELATED SECTIONS

- A. Division 16 - Electrical Identification: Identification of electrical equipment.

1.4 REFERENCES

- A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. SSPC-SP 1 - Solvent Cleaning.
- C. SSPC-SP 2 - Hand Tool Cleaning.
- D. SSPC-SP 3 - Power Tool Cleaning.
- E. SSPC-SP 5/NACE 1 - White Metal Blast Cleaning.
- F. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.
- G. SSPC-SP 10/NACE 2 - Near-White Metal Blast Cleaning.

1.5 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.6 SUBMITTALS

- A. Comply with Division 01 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
- C. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
- D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
 - 1. Project name and location.
 - 2. Name of owner.
 - 3. Name of contractor.
 - 4. Name of engineer.
 - 5. Name of coating manufacturer.
 - 6. Approximate area of coatings applied.
 - 7. Date of completion.
- F. Warranty: Submit manufacturer's standard warranty.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
 - 2. Able to demonstrate successful performance on comparable projects.
 - 3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.
- B. Applicator's Qualifications:
 - 1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
 - 2. Applicator's Personnel: Employ persons trained for application of specified coatings.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
 - 1. Coating or material name.

2. Manufacturer.
3. Color name and number.
4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D 102.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 - PRODUCTS

2.1 MANUFACTURER

1. Tnemec Company Incorporated.
2. Or Equal

2.2 COATING MATERIALS

- A. Tnemec Series 1 Omnithane
 - 1. Generic Type: NSF Approved Aromatic Moisture Cured Urethane Primer
 - 2. Special Qualifications: Certified in accordance with NSF/ANSI STD 61 for potable water applications.
 - 3. Performance Criteria
 - a. Adhesion: ASTM D 4541.
 - b. Humidity: ASTM D 4585. 5,000 hours exposure.
 - c. Salt Spray (Fog): ASTM B 117. 10,250 hours exposure
 - d. Impact: ASTM D 2794.
- B. Tnemec Series 66 Epoxoline
 - 1. Generic Type: Polyamide Epoxy
 - 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Immersion: ASTM D 870. 7 years
 - d. Exterior Exposure: 5 years
 - e. Humidity: ASTM D 4585. 4,500 hours exposure.
 - f. Salt Spray (Fog): ASTM B 117: 10,900 hours exposure.
 - g. Moisture Vapor Transmission: ASTM D 1653
 - h. Prohesion: ASTM G 85. 5,000 hours
- C. Tnemec Series 1074 Endura-Shield II
 - 1. Generic Type: Aliphatic Urethane
 - 2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load):
 - b. Adhesion; ASTM D4541 (Elcometer):
 - c. QUV Exposure; ASTM D 4587. 2,000 hours
 - d. Exterior Exposure: ASTM D 4141 Method C (EMMAQUA): 500 MJ Exposure.
 - e. Salt Spray (Fog); ASTM B117: 5,000 hours exposure.
 - f. Flexibility: ASTM D 522 (Method A)
 - g. Hardness: ASTM D 3363
- D. Tnemec Series 91 H20 Hydro-Zinc
 - 1. Generic Type: NSF Approved Aromatic Moisture Cured Zinc Rich Urethane Primer
 - 2. Special Qualifications: Certified in accordance with NSF/ANSI STD 61 for potable water applications.
 - 3. Performance Criteria
 - a. Adhesion: ASTM D 4541.
 - b. Humidity: ASTM D 4585. 2,000 hours exposure.
 - c. Salt Spray (Fog): ASTM B 117. 50,000 hours exposure
 - d. Impact: ASTM D 2794.

- e. Immersion: ASTM D 870. 7 years.

E. Tnemec Series 446 Perma-Shield MCU

1. Generic Type: Hydrophobic Aromatic Polyurethane
2. Performance Criteria:
 - a. Abrasion; ASTM D4060, (CS-17 Wheel, 1,000 grams load, 1,000 cycles):
 - b. Adhesion: ASTM D4541 (Elcometer):
 - c. Immersion (140 F DI Water): ASTM D 870. 1,000 hours.
 - d. Flexural Strength: ASTM D 790.
 - e. H2S Autoclave (150F, 500 ppm H2S, 4,000 ppm NaCl, 10% H2SO4):
 - f. Elongation: ASTM D 638.
 - g. Moisture Vapor Transmission: ASTM D 1653
 - h. Tensile Strength: ASTM D 2370
 - i. Thermal Expansion: ASTM C 531

2.3 COATING SYSTEMS FOR DUCTILE OR CAST IRON - PIPE, PUMPS, MOTORS, AND VALVES

A. Interior and/or Exterior Exposed:

1. System Type: Epoxy / Polyurethane
2. Primer: Series N140-1211 Pota-Pox Plus: DFT 6.0 – 8.0 mils.
3. Intermediate Coat: Series 66 Hi-Build Epoxoline: DFT 3.0 to 5.0 mils.
4. Finish Coat: Series 1074U Endura-Shield II: DFT 2.0 to 3.0 mils.
5. Total DFT: 11.0 to 16.0 mils.
6. Finish Color: As selected by Engineer from manufacturer's standard colors.

2.4 COATING SYSTEMS FOR GALVANIZED STEEL AND NON-FERROUS METAL PIPE AND MISCELLANEOUS FABRICATIONS

A. Interior and/or Exterior Exposed:

1. System Type: Epoxy / Polyurethane
2. Primer: Series 66 Hi-Build Epoxoline DFT 2.0 to 3.0 mils.
3. Finish Coat: Series 1074U Endura-Shield II: DFT 2.0 to 3.0 mils.
4. Total DFT: 4.0 to 6.0 mils.
5. Finish Color: As selected by Engineer from manufacturer's standard colors.

2.5 COATING SYSTEMS FOR STEEL PIPE AND EQUIPMENT

A. Interior and/or Exterior Exposed:

1. System Type: Zinc Rich Urethane / Epoxy / Polyurethane
2. Primer: Series 91 H2O Hydro-Zinc: DFT 2.5 – 3.5 mils.
3. Intermediate Coat: Series 66 Hi-Build Epoxoline DFT 3.0 to 5.0 mils.
4. Finish Coat: Series 1074U Endura-Shield II: DFT 2.0 to 5.0 mils.
5. Total DFT: 7.5 to 13.5 mils.

6. Finish Color: As selected by Engineer from manufacturer's standard colors.

2.6 COATING SYSTEMS FOR PVC

- A. Interior and/or Exterior Exposed: System Type: Epoxy / Polyurethane
 1. Primer: Series 66 Hi-Build Epoxoline DFT 2.0 to 3.0 mils.
 2. Finish Coat: Series 1074U Endura-Shield II® DFT 2.0 to 3.0 mils.
 3. Total DFT: 4.0 to 6.0 mils.
 4. Finish Color: As selected by Engineer from manufacturer's standard colors.

2.7 COATING SYSTEMS FOR PREVIOUSLY PAINTED FERROUS METAL STRUCTURES AND MISCELLANEOUS FABRICATIONS

- A. Interior & Exterior Exposed (not immersed):
 1. System Type: Epoxy
 2. Primer: Series 135 Chembuild DFT 3.0 to 5.0 mils.
 3. Finish Coat: Series 1074U Endura-Shield II DFT 2.0 to 3.0 mils.
 4. Total DFT: 5.0 to 8.0 mils.
 5. Finish Color: As selected by Engineer from manufacturer's standard colors.
- B. Immersed – Potable Water:
 1. System Type: Zinc Rich Urethane / Epoxy
 2. Primer: Series 91 H2O Hydro-Zinc DFT 2.5 – 3.5 mils.
 3. Intermediate Coat: Series 20 Pota-Pox; DFT 4.0 – 6.0 mils.
 4. Finish Coat: Series 20 Pota-Pox; DFT 4.0 – 6.0 mils.
 5. Total DFT: 10.5 to 15.5 mils
- C. Immersed – Wastewater:
 1. System Type: Mio/Zinc Urethane / MCU
 2. Primer: Series 1 Omnithane; DFT 2.5 – 3.5 mils
 3. Intermediate Coat: Series 446 Perma-Shield MCU; DFT 5.0 – 7.0 mils
 4. Finish Coat: Series 446 Perma-Shield MCU; DFT 5.0 – 7.0 mils
 5. Total DFT: 12.5 to 15.5 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which coating systems are to be applied. Notify Engineer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION OF DUCTILE OR CAST IRON

- A. Surfaces shall be abrasive swept blasted to removal oil, grease, dirt, dust, loose annealing oxides, loose rust and loose mold coatings. Tightly adherent annealing oxides, rust and mold coatings (i.e., unable to be removed by lifting with a dull putty knife) may remain on the surface.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

3.4 SURFACE PREPARATION OF PVC

- A. Prepare PVC surfaces in accordance with manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Scarify PVC surfaces.

3.5 PREPARATION FOR FERROUS METAL STRUCTURES AND MISCELLANEOUS FABRICATIONS

- A. General: Remove hardware, plates, lighting fixtures, and similar items already installed that are not to be painted. Remove these items to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Where indicated for blast cleaning, conform to SSPC-SP 10.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to the manufacturer's instructions for each particular substrate condition and as specified.
- D. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
- E. Touch up bare areas and shop applied prime coats that have been damaged. Any areas having bare metal after surface preparation shall be cleaned in accordance with sspc-sp2

hand tool cleaning or sspc-sp3 power tool cleaning. Feather all edges and touch up with the same primer as the shop coat.

3.6 APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- C. Keep containers closed when not in use to avoid contamination.
- D. Do not use mixed coatings beyond pot life limits.
- E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- F. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.7 REPAIR

- A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.8 FIELD QUALITY CONTROL

- A. Services:
 - 1. Verify coatings and other materials are as specified.
 - 2. Verify surface preparation and application are as specified.
 - 3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.

4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
 - a. Check for holidays on interior steel immersion surfaces using holiday detector.

B. Report:

1. Submit written reports describing inspections made and actions taken to correct nonconforming work.
2. Report nonconforming work not corrected.
3. Submit copies of report to Engineer.

3.9 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

3.10 PROTECTION OF COATING SYSTEMS

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
- B. Provide “Wet Paint” signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

END OF SECTION 09961

SECTION 09963

COATINGS FOR POTABLE WATER TANKS

PART 1 - GENERAL

1.1 SCOPE

- A. This section includes surface preparation, painting, and finishing of exposed interior and exterior coating systems for pre-stressed concrete and steel potable water tanks.
- B. All interior coatings for potable water storage tank surfaces shall be approved for ANSI/NSF standard 61 Drinking Water System. Provide all labor, materials, apparatus, scaffolding, and all appurtenant work in connection with painting and protective coatings, complete as indicated, specified and required.
- C. All products shall be the product of one manufacturer as specified in this document.
- D. Principal items to be coated per Article 2 include, but are not limited to:
 - 1. Interior of the Tank
 - 2. Exterior of the Tank
- E. It is the Contractor's responsibility to examine areas and conditions under which coating systems are to be applied, and to notify the Owner of areas or conditions which are not acceptable. Do not begin surface preparation or application until areas or conditions have been completely corrected.

1.2 COLOR SELECTION

- A. All colors shall be approved by the Owner from Manufacturer's color sheets.

1.3 RELATED SECTIONS

- A. Section 01330 – Submittals
- B. Section 09961 – Painting for Water Treatment Facilities

1.4 REFERENCES

- A. ANSI/NSF 61 – Drinking Water System Components
- B. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.

- C. SSPC-SP 1 - Solvent Cleaning.
- D. SSPC-SP 2 - Hand Tool Cleaning.
- E. SSPC-SP 3 - Power Tool Cleaning.
- F. Without limiting the generality of other requirements of these specifications, all cleaning, surface preparation, and coating shall conform to the applicable requirements of the referenced portions of the standards specified herein to the extent that the requirements therein specified are not in conflict with the provisions of this specification.
- G. Unless otherwise specified, all work and materials for the preparation and coating of all metal surfaces shall conform to the applicable requirements specified in the Steel Structures Painting Manual, Volume 2, Systems and Specifications Revised, latest edition, published by the Society for Protective Coatings (SSPC).

1.5 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.6 SUBMITTALS

- A. Comply with Division 01 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
- C. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
- D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
 - 1. Project name and location.
 - 2. Name of owner.
 - 3. Name of contractor.
 - 4. Name of engineer.
 - 5. Name of coating manufacturer.
 - 6. Approximate area of coatings applied.
 - 7. Date of completion.

- F. Warranty: Submit manufacturer's standard warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Manufacturer Representative

1. The Contractor shall require the manufacturer to furnish a manufacturer's qualified technical representative to visit the project site for technical support as required and ordered and as may be necessary to resolve field questions or problems attributable to or associated with the manufacturer's products furnished under this Contract or the application thereof.

C. Applicator's Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on project of similar size and complexity to this work.
2. Use best practices to carry out corrosion prevention activities in the field.
3. Use best practices in environmental protection to prevent environmental degradation, and to ensure careful handling of all hazardous materials.
4. The Contractor must have a minimum NACE Level 2 or PCI Level 2 certified inspector on staff.
5. The Contractor must submit, with their submittals, a list of a minimum 5 completed projects of similar size and complexity to this work. Include for each project:
 - a. Project name & location
 - b. Name and contact of owner
 - c. Name and contact of engineer
 - d. Approximate area of coatings applied
 - e. Total project amount value
 - f. Date of completion

D. Pre-Application Meeting

1. A pre-application meeting shall be held at least two (2) weeks before the start of application of coating systems. All parties who directly affect the project shall attend, including the Contractor, Manufacturer, and Owner.
2. The pre-application meeting shall include a review of any circumstances which may impact the project including, but not limited to, the following:
3. environmental requirements
4. protection of surfaces not scheduled to be coated
5. surface preparation
6. application

7. disinfection
8. repair
9. field quality control
10. cleaning
11. protection of coating systems
12. 11-month walkthrough
13. coordination with other projects

E. 11-Month Walkthrough:

1. The Owner shall organize a project meeting for 11 months after the final completion date of the entire project which the Contractor, Manufacturer, and Owner shall attend. Participants will perform a walkthrough of the project and resolve any workmanship or materials discrepancies.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. All coatings shall be delivered to the mixing room in unbroken containers, bearing the manufacturer's brand, date of manufacture, and name. They shall be used without alteration and mixed, thinned, and applied in strict accordance with manufacturer's directions for the applicable materials and surface before using.
- B. Coatings shall be delivered to the job site in the original unopened containers, bearing the manufacturer's label. A Product Data Sheet and Safety Data Sheets for all coatings shall be obtained from the manufacturer for each shipment of materials to the job site. Coatings shall be stored in a dry, well-ventilated area, not in direct contact with the ground, where the temperature is maintained between 40°F and 120°F.
- C. Damaged materials and/or materials exceeding the shelf life shall not be used.
- D. The Contractor will be responsible for storing coatings onsite in accordance with the Manufacturer's latest written recommendations.
- E. Coatings shall be mixed in proper containers of adequate capacity. All coatings shall be mixed in accordance with the Manufacturer's latest written recommendations. No unauthorized thinners or other materials shall be added to any coatings. Air shall not be used directly for agitation. Pigmented material shall be strained after mixing. Multiple (2 or more) component catalyzed materials may not be used beyond the recommended pot life.
- F. Work areas will be designated by the Owner for storage and mixing of all materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for

wastes, and no plumbing fixture shall be used for this purpose.

- G. Contractor will be responsible for disposal of all waste, empty containers, etc.
- H. All recommendations of the Manufacturer in regard to the health and safety of workmen shall be followed.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Weather:
 - 1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
 - 2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point. Follow manufactures printed instructions for minimum and maximum application temperatures. Condition material per the manufactures requirements prior to the application of any coating.
 - 3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
 - 4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
 - 5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit, if applicable.
- B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D 102.
- C. Dust and Contaminants:
 - 1. Schedule coating work to avoid excessive dust and airborne contaminants.
 - 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Coatings for potable water tanks referenced herein are based on products manufactured by the Tnemec Company Incorporated. Other manufacturers shall be accepted for products meeting the same technical specifications and performance criteria as those listed herein. Alternate materials for consideration must be submitted at least seven (7) days before the bid opening.
- B. Acceptable Coating Manufacturers:
 - 1. Tnemec Company Incorporated.
 - 2. Sika

3. BASF
 4. International
 5. Approved Equal. In order to be considered for approval, potential alternate products must:
 - a. Be submitted, by the manufacturer, a minimum of 10 days prior to the project bid date to allow time for review.
 - b. Be the same generic type and have the same solids by volume (sbv).
 - c. Maintain the specified total dry film thickness.
 - d. Meet or exceed the performance criteria of the originally specified coatings in Article 2.2.D of this document.
 - e. Include a side-by-side comparison of equality including generic coating description, volume solids, ASTM performance test results, etc.
 - f. Be endorsed by the manufacturer for their intended use on this project.
-
- A. Coatings shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.
 - B. All coatings shall be produced and applied as herein called for or, if not specifically called for, it shall be applied in accordance with the manufacturer's latest printed recommendations as approved by the Owner.
 - C. Coating materials shall meet Volatile Organic Compounds (VOC) requirements of not more than 1 lb/gal. as applied after thinning.
 - D. No coatings containing lead will be allowed.
 - E. Compatibility. Only compatible materials shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to approval of the Owner, a compatible barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.
 - F. Colors. All colors and shades of colors of all coats of material shall be as identified in the color schedule. Each coat shall be of a slightly different shade, as directed by the Manufacturer to facilitate inspection of surface coverage of each coat.

2.2 COATING SYSTEMS

- A. Coating Systems. Coating systems are specified as follows:
 1. Substrate: The Tank Interior, Subject to immersion in potable water, identified in Article 1.02.B as **(1. Interior of the Tank)** shall have the following coating system:
 - a. **Surface Preparation:** Abrasive blast or mechanically abrade in accordance

- with SSPC-SP10/NACE No. 2 to provide a minimum 1.5 mil angular anchor profile.
 - b. **1st Coat:** Series 94H2O Hydro-Zinc @ 2.5 – 3.5 mils dft
 - c. **Pit Filler (As needed to fill sharp, angular pits and voids):** Series 215 Surfacing Epoxy
 - d. **Stripe Coat (Weld Seams, Edges):** Series L140 @ 4.0 – 6.0 mils
 - e. **2nd Coat:** Series 22 Epoxoline @ 22.0 – 35.0 mils dft.
2. Substrate: The Tank Exterior, Subject to UV-exposure, identified in Article 1.02.B as **(2. Exterior of the Tank)** shall have the following coating system:
- a. **Surface Preparation:** Abrasive blast or mechanically abrade in accordance with SSPC-SP6/NACE No. 3 to provide a minimum 1.5 mil angular anchor profile.
 - b. **1st Coat:** Series 94H2O Hydro-Zinc @ 2.5 – 3.5 mils dft.
 - c. **Pit Filler (As needed to fill sharp, angular pits and voids):** Series 215 Surfacing Epoxy.
 - d. **Stripe Coat (Weld Seams, Edges):** Series 27WB @ 4.0 – 6.0 mils dft.
 - e. **2nd Coat:** Series 27WB @ 4.0 – 10.0 mils dft.
 - f. **3rd Coat:** Series V701 @ 2.0 – 3.0 mils dft.
- B. Application. Application shall be in strict conformance with the manufacturer's printed recommendations. All sharp edges, nuts, bolts, or other items difficult to coat shall receive a stripe coat of the specified coating prior to application of each coat.
- C. Color Schedule. The colors in this Article are to be chosen as the Finish Coat colors on the designated surfaces. The Product Manufacturer will choose the colors for all other coats.
- 1. TBD – All surfaces
- D. Coating Performance Criteria.
- 1. Series 22 Epoxoline – Modified Polyamine Epoxy:
 - a. Special Qualification: Certified by NSF International in accordance with NSF/ANSI Std. 61.
 - b. Product must be able to be applied in one single-coat application from 16.0 to 40.0 mils dry film thickness.
 - c. VOC Content: 0.10 lbs/gallon (12 grams/litre)
 - d. Immersion: ASTM 870 – No blistering, cracking, rusting or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F (60°C), average of three tests.
 - 2. Series 27WB Typoxy - Inorganic Hybrid Water-Based Epoxy:
 - a. VOC Content: 0.01 lbs/gallon (0.9 grams/litre)
 - b. Adhesion: ASTM D4541 (Type V Tester) - No less than 1,440 psi (9.93 MPa) pull, average of three tests.

- c. Cyclic Salt Fog/UV Exposure: ASTM D5894 - No blistering, cracking, rusting or delamination of film after 3,000 hours continuous exposure, average of three tests.
 - d. Salt Spray: ASTM B117 - No blistering, cracking, rusting or delamination of film. No more than 3/16 inch rust creepage at scribe after 6,200 hours exposure.
- 3. Series 94H₂O Hydro-Zinc – Zinc-Rich Aromatic Urethane
 - a. VOC Content: 0.74 lbs/gallon (89 grams/litre)
 - b. Special Qualification: Certified in accordance with ANSI/NSF Std. 61 for use on interior potable water tanks of 500 gallons or greater.
 - c. Zinc Pigment: 83% by weight in dried film.
 - d. Adhesion: ASTM D4541 (Type V Self-Aligning Adhesion Tester): No less than 1,713 psi adhesion, average of three tests.
 - e. Salt Spray: ASTM B117 - No blistering, cracking or delamination of film. No rusting on plane and no more than 1/16" rust creepage at scribe after 10,000 hours.
- 4. Series L140 Pota-Pox Plus – Polyamidoamine Epoxy:
 - a. VOC Content: 0.81 lbs/gallon (97 grams/litre)
 - b. Adhesion: ASTM D4541 - No less than 1,943 psi (13.40 MPa) pull, average of three tests.
 - c. Exterior Exposure: ASTM D1014 - No blistering, cracking, checking, rusting or delamination of film. No rust creepage at scribe after 5 years exposure.
 - d. Humidity: ASTM D4585 - No blistering, cracking or delamination of film after 10,000 hours exposure.
 - e. Immersion: ASTM D870 - No blistering, cracking, rusting or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F, average of three tests.
 - f. Salt Spray (Fog): ASTM B117 (2 Coats Series L140) - No blistering, cracking or delamination of film. No more than 1% rusting on plane. No more than 1/16" rust creepage at scribe after 6,700 hours exposure.
 - g. Salt Spray (Fog): ASTM B117 (Series 91H₂O and 2 Coats Series L140) - No blistering, cracking, checking or delamination of film. No more than 1% rusting on plane and no more than 3/16" rust creepage at scribe after 20,000 hours exposure.
- 5. Series 215 Surfacing Epoxy – Modified Polyamine Epoxy
 - a. Special Qualification: Certified in accordance with ANSI/NSF Std. 61 for use on interior potable water tanks of 200 gallons or greater at 80 mils DFT
 - b. VOC Content: 0.08 lbs/gallon
 - c. Adhesion: ASTM D7234 (Method B): Exceeds the cohesive strength of the concrete substrate (400 psi).

- d. Adhesion: ASTM D4541 – Not less than 2,226 psi (15.35 MPa) pull, average of three tests.
 - e. Compressive Strength: ASTM C579 – No less than 9,183 psi (63.3 MPa) compressive strength, average of five tests.
 - f. Flexural Strength and Modulus of Elasticity: C580 – No less than 4,330 psi (29.9 MPa) flexural strength and 324,877 psi (2,240 MPa) flexural modulus of elasticity, average of six tests.
 - g. Flexural Strength and Modulus of Elasticity: ASTM D790 – No less than 10,630 psi (73.29 MPa) flexural strength and 87,440 psi (602.88 MPa) flexural modulus of elasticity, average of three tests.
 - h. Tensile Strength, Elongation, Modulus of Elasticity: ASTM C307 – No less than 2,280 psi (15.72 MPa) tensile strength, average of six tests.
 - i. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D2370 – No less than 2,011 psi (13.86 MPa) tensile strength, 304,213 psi (2,102 MPa) tensile modulus of elasticity and 1.04% elongation, average of ten tests.
 - j. Water Absorption: ASTM C413 – No weight gained after 2 hours continuous boiling water immersion, average of three tests.
6. Series V701 Hydroflon – Advanced Thermoset Solution Fluoropolymer:
- a. VOC Content: 0.81 lbs/gallon (97 grams/litre)
 - b. Exterior Exposure: ASTM D1014 (AAMA 2604-98) (South Florida Marine Exposure) - exceeds the exterior weathering requirements of the American Architectural Manufacturers Association (AAMA) 2604-98 standard.
 - c. Exterior Exposure: ASTM D4141, Method C (EMMAQUA) - No blistering, cracking or chalking. No less than 100% gloss retention, no more than 1 unit gloss loss and no more than 0.23 DEHunter color change (white) after 1,500 MJ/m² (69,109MJ/m² total) EMMAQUA exposure.
 - d. QUV Exposure: ASTM D4587 - No blistering, cracking or chalking. No less than 61% gloss retention (31.4 units gloss change) and 1.89 DEFMC2 (MacAdam units) color change (white) after 25,000 hours exposure.
 - e. Xenon Arc Weathering: ASTM D6695 - No blistering, cracking or chalking. No less than 87% gloss retention (11.9 units gloss change) and no greater than 0.37 DE00 color change (white) after 8,000 hours Xenon Arc exposure.

PART 3 - EXECUTION

3.01 MANUFACTURER'S RECOMMENDATIONS

- A. Unless otherwise specified herein, the manufacturer's latest printed recommendations and instructions for thinning, mixing, handling, applying, and protection of his coating materials; for preparation of surfaces for coating; and for all other procedures relative to coating shall be strictly observed.

3.02 DELIVERY AND STORAGE

- A. Materials shall be delivered in manufacturer's original, sealed containers, with labels and tags intact. Coating materials and equipment shall be stored in designated areas. Coating containers shall be opened only when required for use. Coatings shall be mixed only in designated areas. Coatings shall be thoroughly stirred or agitated to uniformly smooth consistency and prepared and handled in a manner to prevent deterioration and inclusion of foreign matter. Unless otherwise specified or approved, no materials shall be reduced, changed, or used except in accordance with the manufacturer's label or tag on container.

3.03 SAFETY REQUIREMENTS

- A. In accordance with the requirements of applicable OSHA Regulations for Construction, the Contractor shall provide and require the use of personal protective equipment for all persons working in or about the project site.
- B. Respirators shall be worn by all persons in the assigned work area in accordance with OSHA and the Manufacturer's Safety Data Sheet.
- C. Ventilation. Where ventilation is used to control potential exposure to workers as set forth in Section 1910.94 of the OSHA Regulations for Construction, ventilation shall be adequate to reduce the concentration of the air contaminant to the degree that a hazard to the worker does not exist. Methods of ventilation shall meet the requirements set forth in ASNI-Z9.2, latest revision.
- D. Sound Levels. In accordance with Sections 1926.52 and 1926.101 of OSHA Regulations for Construction, whenever the occupational noise exposure exceeds maximum sound levels as set forth in Table D-2 ear protective devices shall be fitted and used, and a continuing, effective hearing conservation program shall be administered.
- E. Cloths and cotton waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each work day.

3.04 STORAGE, MIXING AND THINNING

- A. Materials shall be stored in a dry, well-ventilated area, not in direct contact with the ground, where the temperature is maintained between 40°F and 120°F.
- B. Materials shall be thoroughly stirred, strained, and kept at a uniform consistency during application.
- C. Materials of different manufacturers shall not be mixed together.
- D. Materials may only be mixed and thinned in strict accordance with the manufacturer's latest written recommendations.

3.05 WORKMANSHIP

- A. Skilled craftsmen and experienced supervision shall be used on all work.
- B. All paint and coatings shall be applied to produce an even film of specified uniform thickness.
- C. Edges, corners, crevices, bolts, nuts, and joints shall receive special attention to ensure that they have been thoroughly cleaned and that they receive a film thickness equivalent to adjacent areas.
- D. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish.
- E. The hiding shall be so complete that the addition of another coat of paint would not increase the hiding. All coats shall be applied so as to produce a film of uniform thickness.
- F. Installations shall be protected by the use of drop cloths or other approved precautionary measures. Surfaces from which paint cannot be removed satisfactorily shall be painted or repainted.

3.06 APPLICATION OF PROTECTIVE COATINGS

- A. The Contractor shall give special attention to the work to ensure that edges, corners, crevices, welds, bolts, nuts, and other areas, receive a film thickness at least equivalent to that of adjacent coated surfaces.
- B. Prime coat shall be applied to all clean surfaces the same day of the cleaning, and prior to deterioration or oxidation of the surface, and in accordance with the manufacturer's recommendations.
- C. All coatings shall be applied in a clean and dry environment. No coating or paint shall be applied when the surrounding air temperature, measured in the shade, is below 40°F. No coating or paint shall be applied to wet or damp surfaces and shall not be applied in rain, fog or mist, or when the ambient temperature is less than 5°F above the dew point. No coating or paint shall be applied when it is expected that these adverse conditions will occur within 5 hours after the application of the coatings. Dew or moisture condensation should be anticipated, and if such conditions are prevalent, application shall be delayed to ensure the surfaces are dry.
- D. Each coat must be a slightly different color.
- E. Sufficient time shall be allowed to elapse between successive coats to permit satisfactory recoating, but, once commenced; the entire coating operation shall be completed without delay.

3.07 TESTING AND INSPECTION

- A. The Contractor shall conduct wet film thickness measurements and shall recoat and repair as necessary for compliance with the specifications.
- B. Coating thickness shall be determined by the use of a properly calibrated "Nordson-Mikrotest" or "Positest" Coating Thickness Gauge (or equal) for metal. Please note that a "Tooke" gauge may be used on cementitious surfaces, and that use of the "Tooke" gauge is classified as a destructive test.
- C. Before performing any destructive tests on a newly applied coating system, the Owner and Contractor shall determine which of them is responsible for the cost of repairing the damaged coatings.
- D. Coatings not in compliance with the specifications will not be acceptable and shall be replaced and re-inspected at Contractor's expense until the specifications are met.

3.08 CLEAN-UP

- A. Upon completion of the work, staging, scaffolding, drop-cloths, and containers shall be removed from the site or destroyed in an approved manner. Paint spots, oil, or stains upon adjacent surfaces shall be removed.

3.09 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

3.10 PROTECTION OF COATING SYSTEMS

- B. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
- C. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

END OF SECTION 09963

SECTION 10710
EXTERIOR SHADE SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section includes the furnishing of all labor, materials, and equipment for the manufacture and installation of an exterior fabric shade system as specified herein.
- B. Contractor shall furnish and install fabric shades for the east and south sides of the roof system covering the sodium hypochlorite feed system and storage tank. Shade system shall consist of fabric shade and mounting hardware to shade equipment and reduce UV degradation of the sodium hypochlorite.
- C. Contractor shall coordinate fabric system with the prefabricated steel canopy manufacturer for wind loading caused by the fabric, and all methods of connection and support.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings to the Engineer for review in accordance with Section 01330 for the shade system coordinated with the steel canopy and shall have the Engineer approve same in writing before ordering the equipment.

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers
 - 1. The products of this section shall be provided by a single supplier; who shall demonstrate previous experience in the manufacture of shade systems. The manufacturer must have a service center with trained technicians authorized to make repairs to all components. This supplier shall be responsible for providing all equipment, accessories, spare parts, documentation and installation supervision required for a complete and operational feed system.
 - 2. The manufacturer shall have a minimum of 5 years' experience with a successful record of manufacturing and servicing of systems as specified herein.
 - 3. The manufacturer shall have a proven track record of aftermarket sales and service support on its equipment.

PART 2 - EQUIPMENT

2.1 SHADE FABRIC

- A. Shade fabric shall be knitted of monofilament and tape construction high density polyethylene with Ultra Violet (U.V.) stabilizers and flame retardant.
- B. Design Parameters
 - 1. UV-Block Factor of 90% (minimum)
 - 2. Nominal Thickness: 0.057 inches
 - 3. Fabric Mass: Min. 337 g/m²
 - 4. Light Fastness: 7-8 (Blue Wool Scale)
 - 5. Weather Fastness: 4-5 (Grey Scale Test)
 - 6. Tear Resistance: Warp 210N, Weft 276N
 - 7. Breaking Force: Warp 786N, Weft 1544N
 - 8. Bursting Pressure: Mean 3125kPa
 - 9. Bursting Force: Mean 1775N
- C. Shade fabric shall be treated with fire retardants and pass the requirements established under the NFPA 701 Test Method 2 test standards for flammability.
- D. Color shall be coordinated with Owner.

2.2 FASTENING SYSTEM

- A. Fastening system shall be factory-formed stainless steel tensioning plates pre-attached to fabric canopies at each corner, and cables per the above hemmed into the fabric at the factory and terminating in the bracket.
- B. Posts shall be equipped with an adjustable 360-degree swivel and pivot attachment mechanism to which the tensioning plate fastens. Tensioning plate includes a stainless steel adjustment bolt which, when turned, tensions the fabric for a taut fit.
- C. Fabrics, cables, and brackets which are not pre-assembled at the factory are not acceptable. Cables which attach to posts with u-bolts or 'S' hooks, or are removable, and which do not use a stainless steel bracketing system with single attachment bolt similar to the above are not acceptable.

2.3 ACCEPTABLE MANUFACTURERS

- A. The following manufacturers are approved for the shade system:
 - 1. Shade Systems, Inc. of Ocala, FL
 - 2. Shade 'N Net, Phoenix, AZ

- B. Alternate suppliers of fabric shade system meeting the specifications listed herein shall be approved following demonstration in shop drawing submittal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fastening system shall be attached to the steel posts to maximize shading of the sodium hypochlorite storage tank, piping, and chemical dosing skid. Adjust bolts to tension fabric to a taut fit.
- B. Follow manufacturer's instructions for installation of shade system.

3.2 WARRANTIES

- A. The manufacturer shall provide a minimum five (5) year limited warranty for the fabric shade covering degradation, cracking or material defects resulting from UV exposure, mold or mildew.
- B. Mounting brackets or hardware shall have a one (1) year warranty.

END OF SECTION 10710

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SECTION 11210

VERTICAL TURBINE PUMPS

PART 1 - GENERAL

1.1 SCOPE

- A. The Contractor shall furnish and install vertical turbine pumps, vertical electric motors, and all appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. The Contractor shall test and place in satisfactory operation, as shown on the Plans and as specified, the specified quantity of vertical turbine pumps complete with appurtenances, accessories, and spare parts as will be required to produce a complete and workable installation.
- B. These Specifications are intended to give a general description of what is required, but do not cover all details, which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, shop testing, delivery, and complete installation and field testing of materials, equipment, and appurtenances for the complete pumping system herein specified, whether or not specifically mentioned in the Specifications.
- C. Assume full responsibility for the satisfactory installation and operation of the pumping units as a system.
- D. Ensure pumps furnished are designed, constructed, and installed in accordance with the best practices and methods, and operate satisfactorily when installed, and are manufactured in accordance with Hydraulic Institute Standards.

1.2 RELATED REQUIREMENTS

- A. Ductile Iron Pipe and Fittings: Section 02619
- B. Valves and Accessories: Section 02640
- C. Cast-in-Place Concrete: Section 03300
- D. Electrical: Division 16

1.3 SUBMITTALS

- A. The Contractor shall submit shop drawings to the Engineer for review in accordance with Section 01330 for all major equipment and shall have the Engineer approve same in writing before ordering the equipment.
- B. Submit copies of materials required to establish compliance with specifications, with provisions of General Conditions. Include at least the following:
 - 1. Pump curves for units proposed, showing Total Dynamic Head, Pump Efficiency, Brake Horsepower, Power Input to Electric Drive Motor, and Overall Efficiency (wire to water efficiency) of Pumping Unit for various conditions under which units are to operate, together with descriptive data and specifications describing in detail the construction of the complete units. Plot curves from no flow at shut-off head to pump capacity at minimum specified total head.
 - 2. Manufacturer to furnish evidence that he has equipment of a similar type in satisfactory operating condition for not less than 5 years. Furnish to Engineer a list giving locations and date of installation.
 - 3. Operation and maintenance manuals in accordance with Division 1.
 - 4. Complete list of bill of materials of all equipment.
 - 5. List of manufacturer's recommended spare parts with manufacturer's current price for each item.
 - 6. Total weight of pumping unit including the weight of the single largest part.
 - 7. A statement indicating bearing life.
 - 8. Complete description of the surface preparation and shop prime painting.
- C. Dimensional Data
 - 1. Submit to Engineer for approval, within 45 days after award of Contract, shop drawings certified as correct, showing weights and dimensions necessary for installation of foundations, anchor bolts, piping, and valve connections.
 - 2. Submit anchor bolt sizes, depth of embedment, shear, and pullout strength, for approval.
- D. Critical Speed Calculation
 - 1. The pump manufacturer shall provide a shaft critical speed calculation to review the lateral natural frequency (first and second) mode of the shafting in the pump in order to provide a "dry critical speed". The pump manufacturer shall adjust the configuration as needed to ensure any shaft critical speeds are outside the normal operating range of the pump.

1.4 QUALITY ASSURANCE

- A. A certified factory hydrostatic and performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow or secondary design point, whichever is

greater. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.

- B. Factory testing in accordance with standards of Hydraulic Institute are required for pumps. Submit certified pump performance curves, including head, capacity, brake horsepower, and pump efficiency for each pump supplied. Provide certified data to verify NPSH and submergence required by pumps at secondary operating point is adequate for water levels shown on Drawings.
- C. Test each pump through specified range of flow vs. head/capacity/efficiency with curves plotted at pump design speed. During each test, run pump at each head/capacity condition as specified for sufficient time to accurately determine discharge head, power input, and efficiency. If any pump tested fails to meet any Specification requirement, modify it until it meets all specification requirements.
- D. If any pump tested fails to meet specified efficiency requirements and all reasonable attempts to correct the inefficiency condition are unsuccessful, it will be rejected. Shipment is not permitted until Engineer has approved test results.

1.5 REFERENCE STANDARDS

- A. Ensure design, manufacturing, and assembly of elements of the equipment herein specified are in accordance with, but not limited to, published standards of the following, as applicable:
 - 1. American Gear Manufacturers Association (AGMA)
 - 2. American Institute of Steel Construction (AISC)
 - 3. American Iron and Steel Institute (AISI)
 - 4. American Society of Mechanical Engineers (ASME)
 - 5. American National Standards Institute (ANSI)
 - 6. American Society for Testing Materials (ASTM)
 - 7. American Welding Society (AWS)
 - 8. Anti-Friction Bearing Manufacturers Association (AFBMA)
 - 9. Hydraulic Institute Standards (current edition)
 - 10. Institute of Electrical and Electronics Engineers (IEEE)
 - 11. National Electric Code (NEC)
 - 12. National Electrical Manufacturers Association (NEMA)
 - 13. Occupational Safety and Health Administration (OSHA)
 - 14. Steel Structures Painting Council (SSPC)
 - 15. Underwriters Laboratories, Inc. (UL)
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening applies.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store material to prevent physical damage and theft.
- B. Protect equipment during transportation and installation to avoid damage.

PART 2 - PRODUCTS

2.1 VERTICAL TURBINE PUMPS

A. General:

- 1. Ensure vertical turbine pump installation consists of new pump driven by nationally known motor manufacturer, as detailed below and shown in the Contract Drawings.
- 2. Design and fabrication as referenced below is based upon the pumps as manufactured by Peerless Pump. Terminology used herein may include reference to the specific performance or product of this, or other, manufacturer(s). Such references shall be construed only as establishing the quality of materials, operational features, and workmanship to be used under this Section and shall not, in any way, be construed as limiting competition. Manufacturers listed herein are acceptable provided the requirements and performance criteria specified herein are met.

B. Capacities and Characteristics

- 1. Capacities and characteristics for the vertical turbine pump are as follows:
 - a. Design Flow: 675 gpm
 - b. Design Head: 215 feet
 - c. Motor Speed (max): 1,800 rpm
 - d. Horsepower (max): 50 HP
 - e. Efficiency at Design (min): 80%
 - f. Shut-off Head: 300 feet (min)
 - g. NPSHa: 45 feet
 - h. Pump Discharge Diameter: 8 inches
 - i. Bowl Diameter (max): 12 inches
- 2. Electrical requirements for the pumps shall be as specified on the Drawings and in Division 16.
- 3. Vibration limits set be forth in the standards of the Hydraulic Institute.

C. Pump Impeller

- 1. The impeller shall be of aluminum bronze construction conforming to ASTM B148, C95200. They shall be of one-piece construction, single suction, enclosed vane, and radial flow design. The waterways through the impeller shall have extremely smooth contours, devoid of sharp corners, so as to promote maximum efficiency.
- 2. The impeller is to be balanced and secured to the shaft by means of a stainless steel drive collet for bowl shafts 1-15/16" diameter and smaller. For bowl shafts larger

than 1-15/16" impellers shall be secured to the shaft using a combination of a thrust washer, key and/or snap rings.

3. Impellers shall be adjustable by means of a top shaft-adjusting nut.

D. Pump Bowls

1. The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.
2. Bowls 8" and above shall be flange connected with stainless steel hardware. Bowls below 8" nominal diameter may use either flanged or threaded connections.
3. Bowls shall be designed with smooth passages to ensure efficient operation and their interior shall be coated with Tnemec N140 Pota-Pox Plus, vitreous (porcelain) enamel, or equal.
4. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.

E. Suction Strainer

1. The pump shall be equipped with a cone-shape, basket strainer made of 314L stainless steel.
2. Strainer shall have a free area of not less than four times the suction inlet area. Strainer openings shall be sized to restrict the passage of objects one-half inch sphere size.
3. Strainer shall be threaded to suction bell.

F. Impeller Shaft

1. Impeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
2. The shaft shall be supported by bronze or neoprene bearings located on both sides of each impeller.
3. Impeller shaft coupling shall be 410 stainless steel construction or of a dissimilar alloy to prevent galling.

G. Wear Rings

1. Wear rings shall be provided on both the impellers and bowls on bowls of nominal diameter of 8" or larger so that clearances can be maintained throughout the life of the rings and minimize recirculation. Bowls of 6-inch and 7-inch nominal diameter shall incorporate bowl wear rings only.
2. Impeller wear rings shall be of the radial-type.
3. Bowl wear rings shall be of the radial-type.
4. Wear rings shall be attached to the impellers and bowls using an interference fit and Loctite.
5. Wear rings shall be aluminum bronze conforming to ASTM, B505 C95200.

H. Column

1. Total length of discharge column shall be as verified from the Contract Drawings and recommended by the manufacturer to provide adequate clearance and to maintain the minimum submergence.
2. Column pipe shall be not less than eight (8) inches inside diameter and weigh not less than 30 pounds per foot.
3. Column pipe shall be furnished in interchangeable sections not over ten feet in length, and shall be connected with threaded couplings.

I. Lineshafts

1. Lineshafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.
2. Lineshafting shall be made of 416 stainless steel and be furnished in interchangeable sections not over ten feet in length.
3. Lineshafting shall be coupled with extra-strong threaded steel couplings machined from solid bar steel. Couplings shall be 410 stainless steel or other dissimilar alloy to prevent galling.
4. Lineshafting shall be fitted with stainless steel replaceable sleeves at each bearing and shall be 416 stainless steel.
5. Lineshaft bearings shall be of neoprene material construction.
6. Lineshaft bearings shall be retained in bronze guides that are fitted into the column coupling and secured in place by the butted column pipe ends. For column sizes larger than 16" retainers shall be steel and fabricated into the column assembly.

J. Above Ground Discharge Head Assembly

1. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 150# discharge flange.
2. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.
3. The stuffing box shall be made of cast iron with 316 stainless steel split-type packing gland, studs, and nuts, and furnished with five rings of graphited synthetic fiber packing. The bearing shall be bronze, Type C89835 or equal. A rubber slinger shall be furnished with the stuffing box for securing to the shaft above the packing gland to protect the motor from excess spray. The head shall have a threaded connection in the stuffing box location for connecting a drain pipe..
4. Packing box shall be rated for 175 PSI.
5. Discharge head openings shall be fitted with 316 stainless steel guards to prevent access to the rotating shaft and/or coupling.
6. Sole plate should be fabricated of A36 steel and a minimum of 1.125 inches thick. Sole plate shall be machined to accept the pump discharge head.

K. Available Manufacturers

1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Sterling Fluid Systems Peerless Pump,
 - b. Pentair - Aurora Layne,

- c. Goulds,
- d. Approved Equal.

2.2 MOTORS

- A. Motors shall comply with requirements of Division 16 with the following additional items. If any of the below listed items conflict with Division 16 Specifications, Division 16 Specification shall take precedent.
 - 1. Shaft Steady Bushing
 - 2. Motor Winding Thermostats
 - 3. Non-Reverse Ratchet
 - 4. TEFC
- B. Motor sizes shall be as indicated on the Drawings.
- C. Motors shall have a removable eyebolt or lifting lugs as an integral part of the frame.

2.3 PAINTING

- A. Before exposure to weather and prior to shop painting, ensure surfaces are thoroughly cleaned, dry, and free from mill/scale, rust, grease, dirt, and other foreign matter.
- B. Pumps shall receive a factory applied NSF approved epoxy coating. Coating shall be 10 mils DFT (minimum) and applied to the following:
 - 1. Pump bowl exterior
 - 2. Column interior and exterior
 - 3. Discharge head interior and exterior
- C. Gears, bearing surfaces, and other similar surfaces obviously not to be painted are to be given a heavy shop coat of grease or other suitable rust-resisting coating, maintained as necessary to prevent corrosion during periods of storage and erection, and to be satisfactory to Engineer up to the time of the final acceptance test.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall see that all items of equipment are installed, piped, and wired in accordance with the manufacturer's recommendations and shall place all equipment in satisfactory operation. The equipment shall be checked by a manufacturer's representative to be sure that it has been installed in compliance with recommendations.
- B. All work shall be tested and subject to final approval of the Engineer.

- C. Pump installation shall be in accordance with Manufacturer's recommendations.
- D. There shall be no need for personnel to enter the wet-well during normal operation and maintenance.
- E. The pump Manufacturer shall certify that the installation of the pumps has been tested and all equipment is installed and operating in accordance with their requirements.

3.2 INSTALLATION

- A. Mounting: Mount pumps to concrete pad as shown on the contract drawings.
- B. Electrical: Furnish installation and support of power and control cables between the pumps and the pump control panel.

3.3 WARRANTY

- A. The Contractor shall guarantee the satisfactory operation for all apparatus and machinery against defects in workmanship, material, and installation for a period of one (1) year. The Contractor shall in turn protect himself with similar guarantees from all his suppliers and subcontractors.
- B. The Pump Manufacturer shall guarantee the pumps for against defects in workmanship and/or material for a period of at least one (1) year. The Warranty shall cover all parts and labor and begin commencement at the time of start-up and not exceed two (2) years from the Manufacturer's shipping date. Contractor shall be responsible for storage and/or maintenance of the pumps in compliance with Manufacturer's requirements upon delivery until start-up occurs.
- C. In the event the start-up occurs more than one (1) year after the shipping date, the Contractor shall warrant the pumps, including all parts and labor, for the period of one (1) year after start-up.

3.4 STARTUP AND OPERATION

- A. The Contractor shall review and demonstrate the operation of the pump station, with the Owner representatives, completely familiarizing the operator with all operation procedures.
- B. The pump manufacturer shall furnish the services of a qualified factory trained field service engineer for 8-hour working day(s) at the site to inspect the installation and instruct the owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the Contractor shall have the manufacturer do the following:

1. Megger stator and power cables
2. Check seal lubrication
3. Check for proper rotation
4. Check power supply voltage
5. Measure motor operating load and no load current

3.5 TOOLS AND SPARE PARTS

- A. Manufacturer, if required for normal maintenance, to provide one (1) set of special tools in a suitable steel tool chest, complete with lock and duplicate keys.
- B. The pump manufacturer shall provide a suggested spare parts list to maintain the equipment in service for a period of 5 years. Manufacturer shall include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
- C. Ensure spare parts are properly protected for long periods of storage, packed in containers that are clearly identified with indelible markings as to the contents.

3.6 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall turn over to the Engineer three (3) copies of operation and maintenance manuals for each piece of equipment installed.

END OF SECTION 11210

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SECTION 11230
END SUCTION PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall furnish materials, equipment and labor to furnish, install and test the pumping system complete with the pumps, motors, mounting bases, piping, valves and appurtenances, as indicated on the Contract Drawings and as herein specified.
- B. These Specifications are intended to give a general description of what is required, but do not cover all details, which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, shop testing, delivery, and complete installation and field testing of materials, equipment, and appurtenances for the complete pumping system herein specified, whether or not specifically mentioned in the Specifications.
- C. Assume full responsibility for the satisfactory installation and operation of the pumping units as a system.
- D. Ensure pumps furnished are designed, constructed, and installed in accordance with the best practices and methods, and operate satisfactorily when installed, and are manufactured in accordance with Hydraulic Institute Standards.

1.2 RELATED REQUIREMENTS

- A. Ductile Iron Pipe and Fittings: Section 02619
- B. Valves and Accessories: Section 02640
- C. Electrical: Division 16

1.3 SUBMITTALS

- A. The Contractor shall submit shop drawings to the Engineer for review in accordance with Section 01330 for all major equipment and shall have the Engineer approve same in writing before ordering the equipment.
- B. Submit copies of materials required to establish compliance with specifications, with provisions of General Conditions. Include at least the following:

1. Pump curves for units proposed, showing Total Dynamic Head, Pump Efficiency, Brake Horsepower, and Power Input to Electric Drive Motor for various conditions under which units are to operate, together with descriptive data and specifications describing in detail the construction of the complete units. Plot curves from no flow at shut-off head to pump capacity at minimum specified total head.
2. Manufacturer to furnish evidence that he has equipment of a similar type in satisfactory operating condition for not less than 5 years. Furnish to Engineer a list giving locations and date of installation.
3. Operation and maintenance manuals in accordance with Division 1.
4. Complete list of bill of materials of all equipment.
5. List of manufacturer's recommended spare parts with manufacturer's current price for each item.
6. Total weight of pumping unit including the weight of the single largest part.
7. A statement indicating bearing life.
8. Complete description of the surface preparation and shop prime painting.

C. Dimensional Data:

1. Submit to Engineer for approval, within 45 days after award of Contract, shop drawings certified as correct, showing weights and dimensions necessary for installation of foundations, anchor bolts, piping, and valve connections.
2. Submit anchor bolt sizes, depth of embedment, shear, and pullout strength, for approval.

1.4 RESPONSIBILITY AND SUPERVISION

- A. To assure a properly integrated and compatible system, all equipment described in this section shall be furnished by the Pump Manufacturer, who shall assume full responsibility for the proper operation of the pumps and associated equipment.
- B. The Contractor shall arrange for the Pump Manufacturer to provide a factory-trained representative as required for the purpose of supervising installation, start-up, final field acceptance testing, and providing instruction to the owner's operating personnel in the proper operation and maintenance of the equipment in this section.

1.5 QUALITY ASSURANCE

- A. A certified factory hydrostatic and performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow or secondary design point, whichever is greater. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.
- B. Factory testing in accordance with standards of Hydraulic Institute are required for pumps. Submit certified pump performance curves, including head, capacity, brake

horsepower, and pump efficiency for each pump supplied. Provide certified data to verify NPSH and submergence required by pumps at secondary operating point is adequate for water levels shown on Drawings.

- C. Test each pump through specified range of flow vs. head/capacity/efficiency with curves plotted at pump design speed. During each test, run pump at each head/capacity condition as specified for sufficient time to accurately determine discharge head, power input, and efficiency. If any pump tested fails to meet any Specification requirement, modify it until it meets all specification requirements.
- D. If any pump tested fails to meet specified efficiency requirements and all reasonable attempts to correct the inefficiency condition are unsuccessful, it will be rejected. Shipment is not permitted until Engineer has approved test results.
- E. Seal test results, signed by an officer of pump manufacturer or test lab manager, and submit to Engineer for review and approval prior to shipment.

1.6 REFERENCE STANDARDS

- A. The work in this section is subject to the requirements of applicable portions of the following standards:
 - 1. Hydraulic Institute Standards
 - 2. IEEE Standards
 - 3. NEMA Standards
 - 4. OSHA Rules and Regulations

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store material to prevent physical damage and theft.
- B. Protect equipment during transportation and installation to avoid damage.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- A. The pump(s) shall be single stage, frame mounted, centrifugal end suction pump complete with pump, motor, frame, coupling and coupling guard.
- B. Pump shall be NSF 61 approved.
- C. Pump shall be mounted on a heavy-duty cast-in-one-piece cast iron bearing frame with integrally cast feet to mount on a common base frame.

- D. Design and fabrication, as referenced below, is based upon the pumps as manufactured by Grundfos. Terminology used herein may include reference to the specific performance or product of this, or other, manufacturer(s). Such references shall be construed only as establishing the quality of materials, operational features, and workmanship to be used under this Section and shall not, in any way, be construed as limiting competition. Manufacturers listed herein are acceptable provided the requirements and performance criteria specified herein are met.

2.2 ACCEPTABLE MANUFACTURERS

- A. All End Suction Pumps shall be from a single manufacturer
- B. Acceptable Manufacturers shall be:
 - 1. Grundfos PACO Model LF (basis of design)
 - 2. Goulds
 - 3. Approved Equal

2.3 CONDITIONS OF SERVICE

- A. The End Suction Pumps shall have the following conditions of service:
 - 1. Number of Units: 2
 - 2. Fluid: Potable Water
 - 3. Installation: Exterior, covered
 - 4. Type of Drive: constant speed
 - 5. Discharge Size: 1.25 in (min)
 - 6. Suction Size: 1.5 in (min)
 - 7. Design Capacity: 125 US gpm
 - 8. Design Head: 85 feet
 - 9. Efficiency at Design: 59% (min)
 - 10. Rotative Speed: 3,600 RPM (max)
 - 11. Shut-off Head: 115 feet (min)
 - 12. Drive Horsepower: 7.5 hp (max)
 - 13. NPSHa: 65 feet
- B. Specified design point shall fall to the right of the pump BEP so that at reduced speeds the operating point tracks through the most efficient portion of the pump curve

2.4 MATERIALS OF CONSTRUCTION

- A. The pump shall be constructed of the following acceptable materials:
 - 1. Casing:
 - a. Class 30 Cast Iron (ASTM A48)
 - 2. Impeller:
 - a. Aluminum Bronze (ASTM B148 C95400)

3. Shaft:
 - a. Stressproof Steel (AISI 1144)
 - b. Carbon Steel (AISI C1045)
4. Shaft Sleeve:
 - a. Bronze III932 C89835
 - b. 316SS (ASTM A351 CF8M)
5. Mechanical Seals:
 - a. Carbon – Ceramic with Buna Elastomers and Stainless-Steel hardware
6. Case Wear Ring:
 - a. Tin Bronze (ASTM B584-90500)
 - b. Bronze (ASTM B62)
7. Bearing Frame:
 - a. Cast iron (ASTM A48 - Class 30)

2.5 CASING

- A. Pump casing shall have double-volute casings with suction splitter to reduce radial loading and shaft deflection. All pumps shall be of the back pull-out design so that the rotating element can be removed from the casing without disconnecting the suction or discharge piping.
- B. Volute shall have integrally cast suction and discharge connections. Pumps with discharge size 2.5" and larger shall have full flanged connections on both suction and discharge. Suction and discharge flanges shall be drilled to ANSI Class 125# standards and be machined flat face.
- C. The casing shall have tapped and plugged holes for priming, vent and drain.
- D. Casings shall be designed for scheduled working pressure and can withstand hydrostatic test at 150% of the maximum working pressure under which the pump could operate at design speed.

2.6 IMPELLER

- A. The impeller shall be designed to give the characteristics specified herein. It shall be of the enclosed type, cast in one piece. It shall be furnished all over, the exterior being turned and the interior being furnished smooth and cleaned of all burrs, trimmings and irregularities. The impeller will be dynamically balanced. It shall be held securely to the shaft by a key of ample size and shall be locked in place by threaded shaft sleeves.

2.7 SHAFT SLEEVES

- A. The pump shaft shall be fitted with a shaft sleeve to minimize shaft wear. Shaft sleeves shall be extended from the hub of the impeller through the seal box area. They shall be

sealed at the impeller hub by a Buna O-ring to prevent pumped liquid from contacting the shaft. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.

2.8 CASE WEARING RING

- A. The pump casing shall be fitted with a case wear ring to minimize abrasive and corrosive wear to the casing. The wear rings shall be of the radial type, shall have a shoulder machined around the circumference to match a machined shoulder in the casing to provide two sealing faces and to locate the rings in the casing. The rings shall be securely located from rotation.

2.9 MECHANICAL SEALS

- A. The pump manufacturer shall recommend the proper mechanical seal based on the pressure, temperature and liquid outlined on the equipment schedule.
- B. Mechanical seals, at a minimum, shall have ceramic stationary seats, carbon rotating rings, Buna elastomers and stainless steel hardware.
- C. Application of a mechanical seal shall be through external, stainless steel flushing lines. Seals shall be capable of being inspected and easily replaced without removing the piping or volute.

2.10 SHAFT

- A. The pump shaft shall be one-piece, finished and polished on all sections. The shaft shall be of ample strength and rigidity and the shortest practicable distance between bearings shall be used to keep deflection and vibration to a minimum. The maximum allowable deflection of the shaft is 0.002 inches at any point of operation on the pump curve.

2.11 BEARINGS

- A. The bearing frame shall be of the back pull-out design and supply support for heavy-duty single row, double shield, deep groove greased for life ball bearings. The pump shaft shall be adequately supported by the pump bearings to limit the shaft deflection to 0.002 inches. Bearing shall provide a minimum L10 life of 20,000 hours.

2.12 COUPLING

- A. A Falk SteelFlex coupling shall be provided to connect the pump shaft to the motor shaft.

2.13 BASEPLATE

- A. The pump and motor shall be mounted on a groutable cast iron or welded structural steel baseplate or a steel drip rim baseplate with integral drip channels incorporated on each side. Each channel shall include an NPT connection and plug. The base shall be sufficiently rigid to support the pump and motor without the use of additional supports or members.

2.14 MOTOR

- A. The motor shall be horizontal, TEFC, and in accordance with the latest NEMA standards.
- B. Motors shall comply with requirements of Division 16 with the following additional items. If any of the below listed items conflict with Division 16 Specifications, Division 16 Specification shall take precedent.
 - 1. Motor Winding Thermostats
- C. Motor sizes shall be as indicated on the Drawings.
- D. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor. The motor shall have a service factor of at least 1.15. The service factor is reserved for variations in voltage and frequency.
- E. Motor shall be nameplated as inverter duty.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall see that all items of equipment are installed, piped, and wired in accordance with the manufacturer's recommendations and shall place all equipment in satisfactory operation. The equipment shall be checked by a manufacturer's representative to be sure that it has been installed in compliance with recommendations.
- B. All work shall be tested and subject to final approval of the Engineer.
- C. Pump installation shall be in accordance with Manufacturer's recommendations.
- D. The pump Manufacturer shall certify that the installation of the pumps has been tested and all equipment is installed and operating in accordance with their requirements.

3.2 INSTALLATION

- A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Contractor.
- B. The Contractor shall insure that the pumps and motors are properly installed with no pipe strain transmitted to the pump casing.
- C. Mounting: Mount pumps to concrete pad as shown on the Contract Drawings.
- D. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- E. Electrical: Furnish installation and support of power and control cables between the pumps and the pump control panel.

3.3 WARRANTY

- A. The Contractor shall guarantee the satisfactory operation for all apparatus and machinery against defects in workmanship, material, and installation for a period of one (1) year. The Contractor shall in turn protect himself with similar guarantees from all his suppliers and subcontractors.
- B. The Pump Manufacturer shall guarantee the pumps for against defects in workmanship and/or material for a period of at least one (1) year. The Warranty shall cover all parts and labor and begin commencement at the time of start-up and not exceed two (2) years from the Manufacturer's shipping date. Contractor shall be responsible for storage and/or maintenance of the pumps in compliance with Manufacturer's requirements upon delivery until start-up occurs.
- C. In the event the start-up occurs more than one (1) year after the shipping date, the Contractor shall warrant the pumps, including all parts and labor, for the period of one (1) year after start-up.

3.4 TOOLS AND SPARE PARTS

- A. Manufacturer, if required for normal maintenance, to provide one (1) set of special tools in a suitable steel tool chest, complete with lock and duplicate keys.
- B. The pump manufacturer shall furnish the following spare parts for each pump:
 - 1. One (1) set of seals.
 - 2. One (1) set of bearings.
 - 3. One (1) set of O-rings and gaskets

- C. Ensure spare parts are properly protected for long periods of storage, packed in containers that are clearly identified with indelible markings as to the contents.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall turn over to the Engineer three (3) copies of operation and maintenance manuals for each piece of equipment installed.

END OF SECTION 11220

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SECTION 11250

WATER SUPPLY DISINFECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section includes the furnishing of all labor, materials, equipment, documentation, training and startup services for the manufacture and installation of skid mounted chemical metering systems suitable for application of sodium hypochlorite as shown on the drawings and specified herein.
- B. Supplier of skid mounted disinfection system shall provide all necessary components for a complete and working system. Components shall include the necessary equipment including, but not limited to, chemical metering skid, pumps, VFDs, piping, valves, accessories, and spare parts.
- C. Supplier shall provide services associated with the testing, installation, documentation, start-up, and training.

1.2 RELATED REQUIREMENTS

- A. Cast-in-Place Concrete: Section 03300
- B. Electrical: Division 16

1.3 SUBMITTALS

- A. The Contractor shall submit shop drawings to the Engineer for review in accordance with Section 01330 for all major equipment and shall have the Engineer approve same in writing before ordering the equipment.
- B. Submit copies of materials required to establish compliance with specifications, with provisions of General Conditions. Include at least the following:
 - 1. Submit shop drawing and product data for the equipment provided. Include detailed schematic of equipment, piping, controls, etc.
 - 2. Submit a list of the manufacturers recommended spare parts, special tools and lubricants. List shall include local source for supply of all parts and professional service.
 - 3. Submit a cross-sectional sample of pipe joining practices for inspection. Only those manufacturers providing acceptable samples will be considered.

4. Submit fifteen (15) separate references where similar chemical metering systems have been in successful operation for a minimum of 2 years.
5. Submit a copy of proposed manufacturer's guarantee and local parts/service center information.
6. Maintenance Proposal - Provide for the Owners' consideration a proposal for professional annual maintenance of the chemical metering skid. This proposal shall include the services of a qualified technician to perform maintenance as recommended by the manufacturer. The proposal shall include schedule of services to be performed.
7. Manufacturer to furnish evidence that he has equipment of a similar type in satisfactory operating condition for not less than 5 years. Furnish to Engineer a list giving locations and date of installation.
8. Operation and maintenance manuals in accordance with Division 1.
9. List of manufacturer's recommended spare parts with manufacturer's current price for each item.
10. Total weight of skid unit.

C. Dimensional Data:

1. Submit to Engineer for approval, within 45 days after award of Contract, shop drawings certified as correct, showing weights and dimensions necessary for installation of foundations, anchor bolts, piping, and valve connections.
2. Submit anchor bolt sizes, depth of embedment, shear, and pullout strength, for approval.

1.4 QUALITY ASSURANCE

A. Acceptable Manufacturers

1. The products of this section shall be provided by a single supplier; who shall demonstrate previous experience in the manufacture of skid-mounted chemical metering systems. The manufacturer must have a service center with trained technicians authorized to make repairs to all components of the chemical feed system. This supplier shall be responsible for providing all equipment, accessories, spare parts, documentation and installation supervision required for a complete and operational chemical feed system.
2. The manufacturer shall supply fifteen separate references with contact names and phone numbers, where substantially similar installations for the equipment as specified has been in satisfactory operation for a minimum of two years.
3. The pump skids shall be a regularly marketed product of the manufacturer who must have a physical plant, technical and design staff, and production personnel to complete the work as specified. Systems assembled by second party fabricators, integrators, equipment-distributors/representatives or contractors shall not be acceptable. The chemical metering skids shall be assembled and tested by the manufacturer prior to delivery.
4. The manufacturer shall have a minimum of 5 years' experience with a successful record of manufacturing and servicing of systems as specified herein.

5. The manufacturer shall have a proven track record of aftermarket sales and service support on its equipment.

1.5 SERVICE CONDITIONS

- A. Chemical name: Sodium hypochlorite
 1. Concentration: 12.5 Trade Percent
 2. Specific Gravity: 1.1 to 1.2
 3. Maximum Temperature: 100° F

PART 2 - EQUIPMENT

2.1 GENERAL

- A. The chemical metering systems shall be completely self-contained and designed to safely feed metered amounts of all chemicals as listed herein. Each chemical metering skid shall include chemical metering pumps, accessories, controls and options as specified herein and on the Contract Drawings. The chemical metering skids will be completely assembled and tested prior to delivery to the job site. All equipment shall be of materials selected specifically for use with all chemicals listed herein.
- B. Design Conditions:
 1. Point of Application: Well Discharge
 - a. Pressure: 35 psi
 - b. Chemical Dosing Rate: 3.0 GPH (max)
 - c. Chemical Dosing Rate: 0.6 GPH (normal)
 - d. Hours of Operation: 8-12 hrs/day
- C. Skid Design Summary:
 1. No. of Pumps: 2
 2. Chemical: Sodium Hypochlorite (NaOCl)
 3. Pump Type: Peristaltic
 4. Controller: Electronic
 5. Stroke Rate: Automatic
 6. Pump Capacity: 4.2 GPH
 7. Pump Pressure: 75 psi
 8. Piping Material: PVC
 9. Valve Type: Ball
 10. Skid Piping Outputs: One
 11. Skid Containment: Yes
 12. Surge Protection: Yes

2.2 CHEMICAL METERING SKIDS

A. Skid Construction

1. Skid shall consist of welded HDPE.
2. Skid shall incorporate provisions for leak containment and drainage.
3. Maximum skid depth shall be 30" to allow for passage through a standard doorway.
4. Skid shall incorporate forklift slots for easy lifting and placement.
5. Piping to be solvent-welded schedule 80 PVC. Valves to be Asahi True Union ball valves with PTFE seats and Viton o-rings. Pipe supports and clips to be non-metallic, chemical and corrosion-resistant. Terminate suction and discharge piping within 2" of skid boundary.

B. Appurtenances

1. Appurtenances shall be adequately sized and constructed from materials compatible with the process.
2. Each pump shall have dedicated isolation valves and drain/sample ports.
3. Each pump shall have dedicated pressure gauges with isolation diaphragms. Pressure gauges to be liquid-filled, 0-100 psi pressure range. Include pressure gauge calibration reports with Operation and Maintenance Data.
4. Each pump shall have dedicated adjustable pressure relief valves. Pressure relief valves shall be factory set.
5. Skid shall incorporate a vented calibration column that can be used by either pump.
6. Skid shall incorporate back pressure valves on each pump to prevent siphoning and varying dosing rates due to injection point pressure.

2.3 CHEMICAL METERING PUMPS

A. Pump

1. Pump shall be of the gap-coupled, positive displacement, peristaltic hose type utilizing a flexible hose and a rotor with 2 integral pressing shoes. Pump rotor shall be directly bolted onto an internal drive shaft and the complete assembly shall be mounted in the pump casing via sealed for life deep groove 304L stainless steel ball bearings to ISO 15-1998. These bearings shall be press fitted into the pump casing and the bearings shall be protected by a Viton shaft seal. To ensure flexibility and efficiency of installation, pumps 1" and smaller shall have a maximum footprint of 150 square inches.
2. The gear reducer shall be vertically mounted and shall lock onto to the drive shaft by an ISO standard key. The exterior of the pump casing shall be connected to the gearbox by a torque arm assembly which shall incorporate a protective shaft cover. The gear reducer shall be physically isolated from the pump casing via an air gap separation and shall have zero risk of contamination from the pumped fluid. Air-gap separation shall be no less than 1/2".
3. Each pump shall consist of a sealed lubricant filled housing, bolted housing cover, pump hose, rotor assembly, and one-piece connectors. The lubricant shall normally

- be a compounded food grade glycerin/propylene glycol blend. Lubrication shall be filled to 40-50 percent of pump housing capacity.
4. The hose shall be constructed from an appropriate elastomer reinforced by two or more braided nylon layers. Hose shall normally be constructed from a combination of a Natural Rubber outer and an inner made from Hypalon. Hose shall have a permanent color coded material identifier bonded onto the hose's outer cover and this identification shall be incorporated along the entire length of the hose. Identification of hose material by means of partial color coding or by labels of any form shall be unacceptable. Hose shall not require additional processing such as machining to maintain wall thickness and maintain consistent hose occlusion. Exterior surface of hose shall be textured to increase adhesion of lubricant on the portion of hose not otherwise submerged, in order to better cool and lubricate the upper-half of the hose. All hoses regardless of size shall be rated for a minimum of 175 PSIG continuous operation and have a minimum burst pressure of 800-PSIG.
 5. The hose shall be in contact with the inside diameter of the housing through an angle of 180 degrees and be held in place on the suction and discharge ports by 304SS split flanges with polypropylene wetted inserts. Flanges shall be secured to the pump hose via a tapering compression fit forming a sealed pumping chamber that will contain product in the event of a hose failure. The front and rear of the pump casing shall include a pair of cut outs that allows the ends of the hose to be seen to confirm that it is correctly clamped without compromising the integrity of the sealed pumping chamber. Pumps using external or internal hose clamps, or pumps that do not offer product containment within the pump housing shall be unacceptable. The hose shall be replaceable without removing the pump or the pump housing cover.
 6. The rotor shall be constructed of cast iron with two integral pressing shoes, located 180-degrees apart for compression of the hose against the track twice per rotor revolution. Hose occlusion shall not need adjustment by the addition or removal of shims from under a shoe.
 7. Each rotor assembly shall have ribbed spokes, which add to its structural integrity while creating constant circulation of lubricant upon rotation to enhance lubrication and cooling within the pump housing. Rotor material to be ASTM A35.
 8. Flow through the hose shall be in the direction of the rotor rotation, which can be reversed.
 9. Each pump shall be completely self-priming with a suction lift capability of at least 27 feet of water.
 10. The pump shall be capable of running dry without damaging effects to the pump or hose.
 11. The pump shall be valve-less and without diaphragms and not utilize any dynamic seals in contact with the pumpage.
 12. The pump housing shall be cast iron to ASTM A35 and the housing cover shall be steel with Polycarbonate window to view pump rotation. The seal between the housing and the cover shall be a Buna-N O-ring.
 13. Pumps shall be produced in compliance with ISO 9001:2000.

14. Pump support frames shall be formed carbon steel ASTM A529 grade 43 and shall have a powder coated paint finish.
15. The peristaltic hose pumps furnished under this Section shall be Verderflex Dura 5 as manufactured Verder, Inc. of Macon, GA.

B. Pump Motor

1. The AC drive motor shall be totally enclosed non-ventilated type (TENV), Inverter Duty rated and Washdown Duty, and shall be designed as specified herein. The horsepower shall be adequate to drive the pump when the pump is operating at its maximum capacity and maximum head condition for its prescribed application. Motor shall be supplied with sufficient turndown capability to meet specified range of flow.

C. Gear Reducers

1. The gear reducer shall be of worm gear design and shall be of a non-proprietary design and can be supplied or replaced by any commercial gear reducer manufacturer.
2. Match torque rating of gear reducer to the pumping equipment being driven.
3. The input shall be flanged to accept NEMA C-faced motor.
4. Bearings shall be anti-friction, of heavy-duty construction and exceed AFBMA standards.
5. Gear reducer bearings and gears to be greased-for-life and not require any relubrication or other maintenance for the life of the pump.

D. Leak Detection

1. Provide each pump with an over-pressure/hose burst device above the normal lubricant level to high pressure and detect leakage of pumped product into the pump housing for indication of hose failure.
2. Device shall be a field selectable NO/NC two-wire switch, work from a 110V power supply, and relay outputs to monitor high pumping chamber pressures caused by hose failure.

E. VFD Controls

1. Pumps to include NEMA 4X VFD for SCADA interface. Mount VFD directly to pump motor. VFD power supply shall be 1/60/115VAC, with 3/60/230VAC output to motor. VFD shall be prewired to motor and include 6' power cord with three-prong plug. VFD to accept remote run signal via dry contact and remote speed control via 4-20 mA analog signal. VFD shall be capable of returning a 'drive fail' signal to SCADA. VFD to include LCD display and keypad interface for programming and should display pump output in GPH.
2. VFD shall be manufactured by VACON.

2.4 CHEMICAL FEED PIPING

- A. The Contractor shall furnish and install the required chemical feed piping, including pipe supports, between the storage tanks and metering skid system. Pipe supports shall be Clic-X pipe supports and SS316 strut as applicable for pipe supports. All valves shall be true union PVC ball valves with Viton o-rings with PTFE seats. All piping shall be socket welded and threaded connections shall only be used when there is no other practical solution. All piping shall be Schedule 80 PVC.

2.5 CHEMICAL DIFFUSER

- A. The Contractor shall furnish and install the chemical injector quill at the location(s) shown on the Drawings.
- B. Quill shall be manufactured as specified:
 - 1. Process Valve: Stainless Steel
 - 2. Piping Material: Sch 80 PVC
 - 3. Pipe Tap Size: 1-inch
 - 4. Diffuser Lining: Teflon
 - 5. Diffuser Size: ½-inch
 - 6. Chemical Connection Size: ½-inch
- C. Injector quill shall be installed with length such that injection point is at center of piping with beveled edge facing upstream for dispersal
- D. Acceptable Manufacturers
 - 1. Odyssey Manufacturing
 - 2. Approved Equal

2.6 SPARE PARTS

- A. Provide the following spare parts to the OWNER for each chemical metering skid upon delivery of the pump skid.
- B. Spare parts shall include all parts required for (2) years of normal maintenance of all components of the chemical metering system.
- C. All parts shall be in one box labeled with the Skid ID Information:
 - 1. One (1) complete spare pump and VFD.
 - 2. Two (2) spare hoses, two (2) sets of O-rings, two (2) sets of boots & band clamps (if utilized), and two (2) lubricant refills for each chemical metering pump
 - 3. One (1) maintenance kits for a pressure relief valve for each pump skid.
 - 4. One (1) maintenance kit for a back pressure valve for each pump skid.
 - 5. Two (2) spare valves for each pump skid.
 - 6. One (1) parts list for all serviceable components.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the chemical metering skids as indicated on the drawings and specified and in compliance with the manufacturer's instructions.

3.2 INSPECTION AND TESTING

- A. Upon completion of installation, a full operating test shall be performed in the presence of the Engineer and a qualified manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted.

3.3 MANUFACTURER'S SERVICES

- A. The manufacturer shall provide the following services as specified.
 - 1. Mechanical Start-Up Services shall consist of one (1) eight (8) hour working day.
 - 2. Process Start-Up Services shall one (1) eight (8) hour working days.
 - 3. Operator Training Services shall consist of one (1) eight (8) hour working day to instruct operating personnel on the operation and maintenance of the system.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. Operating and maintenance manuals prepared specifically for this project shall be provided. Manuals shall include all procedures, drawings, parts lists, etc. required to instruct personnel unfamiliar with such equipment. Operation and maintenance manuals shall be prepared in accordance with all specifications of this project.

3.5 WARRANTIES

- A. The system manufacturer shall provide a two (2) year parts and labor warranty for the metering pumps, skid material/construction, and skid-mounted equipment, piping and valves. This warranty shall be in addition to and not in lieu of any warranties provided by the manufacturer of the equipment itself
- B. The system manufacturer shall pass through any warranties from the equipment suppliers for the pumps, controllers, and other system components manufactured by others.

END OF SECTION 11250

SECTION 11302

BLADDER TYPE HYDROPNEUMATIC TANKS

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section includes the furnishing of all labor, materials, equipment, documentation, training and startup services for the manufacture and installation of a bladder type, pre-charged hydropneumatic tank(s) as shown on the drawings and specified herein.
- B. The tank is designed as a pump control vessel to a community water system of approximately 50 residential connections. The tank and any ancillary equipment specified herein shall be compatible and in complete conformity with these Specifications. The tank equipment specified herein is intended to be new, standard equipment for use in a hydropneumatic tank system.
- C. The hydropneumatic tank(s) shall be ASME water expansion tank(s) equipped with a replaceable bladder for potable water use applications. Tanks will be pre-charged designed to deliver water under pressure between pump cycles providing sufficient flow to meet demands.

1.2 RELATED REQUIREMENTS

- A. Ductile Iron Pipe and Fittings: Section 02619
- B. Valves and Accessories: Section 02640
- C. Cast-in-Place Concrete: Section 03300
- D. Coatings for Potable Water Tanks: Section 09963
- E. Electrical: Division 16

1.3 SUBMITTALS

- A. The Contractor shall submit shop drawings to the Engineer for review in accordance with Section 01330 for all major equipment and shall have the Engineer approve same in writing before ordering the equipment.

- B. Submit copies of materials required to establish compliance with specifications, with provisions of General Conditions. Include at least the following:
 - 1. Submit shop drawing and product data for the equipment provided. Include detailed schematic of equipment, piping, controls, etc.
 - 2. Submit a list of the manufacturers recommended spare parts, special tools and lubricants. List shall include local source for supply of all parts and professional service.
 - 3. Submit a copy of proposed manufacturer's guarantee and local parts/service center information.
 - 4. Operation and maintenance manuals in accordance with Division 1.
 - 5. Total weight of tank unit and accessories.
- C. Dimensional Data:
 - 1. Submit to Engineer for approval, within 45 days after award of Contract, shop drawings certified as correct, showing weights and dimensions necessary for installation of foundations, anchor bolts, piping, and valve connections.
 - 2. Submit anchor bolt sizes, depth of embedment, shear, and pullout strength, for approval.

1.4 QUALITY ASSURANCE

- A. The tank manufacturer shall have extensive experience in the design and manufacturing of potable hydropneumatic storage tanks of similar capacity and shall submit proof of successfully operating systems using the equipment furnished.
- B. The products of this section shall be provided by a single supplier; who shall demonstrate previous experience in the manufacture of hydropneumatic tank systems.
- C. The tank and all system components shall meet all applicable ASME requirements and will include all necessary interface valves, safety relief assemblies, and instrumentation to meet the requirements of the project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. The equipment provided under this section shall be shipped handled and stored in accordance with the manufacturer's written instructions and in accordance with Section 01605

1.6 WARRANTY AND GUARANTEES

- A. Provide warranty and guarantees for all equipment and work.

PART 2 - PRODUCTS

2.1 STORAGE TANK

A. Design Parameters

1. Pressure (max): 125 PSIG
2. Temperature (min): 20°F
3. Temperature (max): 120°F
4. Capacity (min): 500 gal

B. Tank Construction

1. Orientation: Vertical
2. Connection: Epoxy Lined, Tank Bottom
3. Shell: Carbon Steel
4. Exterior Coating: Carbocoat 140 (or equal)
5. Bladder: Heavy Duty Butyl
6. Diameter (max): 48 inch
7. Height (max): 84 inch

C. The tank shall have the following openings/connections:

1. One 3" flange for inlet/outlet connection
2. One air charging valve (0.302" – 32 TPI)
3. Pressure gauge port

D. The tank shall be designed, fabricated, tested, and stamped in accordance with ASME section VIII.

E. Tank bladder shall be FDA approved and meet NSF 61 standards. Tank design shall allow for replacement of bladder.

F. Welded steel tank supports shall be provided with the tank. The supports shall be provided by the tank manufacturer shall be painted the same as the tank. Tank color shall be blue.

G. Tank nameplate shall include ASME rating and include other pertinent tank information such as capacity, dimensions, material, etc.

H. Acceptable Manufacturers

1. Wessels Company
2. Hanson Tank (Roy E. Hanson Jr. Mfg.)
3. Pulsco, Inc.
4. Approved Equal

PART 3 - EXECUTION

3.1 HANDLING AND STORAGE

- A. All tanks should be moved using the lift lugs welded to the unit (if equipped). Lifting the tank by clipping an eye hook into the lift lugs is the safest and most effective way to move the unit. Note that not all lift lugs are placed at the center of gravity, the unit may shift once lift off the ground. Ensure that the weight of the unit does not exceed the rating of the rigging equipment.
- B. Cover all units with a tarp to protect from the elements. Cover all openings on the units to prevent foreign matter from entering the unit.
- C. Place in a safe location, away from heavy traffic. Do not store in area prone to flooding.
- D. Bladder tanks are under pressure during shipment. Damaging these tanks could be extremely dangerous.

3.2 INSTALLATION

- A. Installation of the tank and equipment shall be in accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Equipment shall be installed by experience and mechanically skilled workmen with previous experience in similar installations.
- B. All necessary piping, fittings, valves, air relief valves, vents, concrete foundations, anchor bolts, grouting, etc. shall be provided to ensure a complete and satisfactory installation of the tank and equipment.
- C. All brackets, bolts, nuts, washers, and other hardware items shall be Type 316 stainless steel.
- D. All equipment containing moving parts shall be installed level and plumb, unless otherwise indicated in the Drawings or in the specifications; and shall be anchored securely in order that noise be suppressed to a minimum and that vibrations do not cause damage while in operation.

3.3 INSPECTION AND PRESSURE TESTING

- A. The tank and associated piping shall be pressure tested in accordance with Section 15021.
- B. After the facility is in operation, a full operating test shall be performed in the presence of the Engineer and the Owner on the system. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted,

by repairing or replacing the defective component, and retesting as required until the equipment meets the satisfaction of the Engineer.

3.4 DISINFECTION AND BACTERIOLOGICAL TESTING

- A. After the interior coatings have been applied, the tank shall be cleaned and disinfected in accordance with AWWA C652-02.
- B. After the tank has been disinfected, it shall be tested for bacteriological quality.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. Operating and maintenance manuals prepared specifically for this project shall be provided. Manuals shall include all procedures, drawings, parts lists, etc. required to instruct personnel unfamiliar with such equipment. Operation and maintenance manuals shall be prepared in accordance with all specifications of this project.

3.6 WARRANTIES

- A. The system manufacturer shall provide a one (1) year parts and labor warranty for the system. This warranty shall be in addition to and not in lieu of any warranties provided by the manufacturer of the equipment itself

END OF SECTION 11302

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SECTION 13211

PEDESPHERE ELEVATED WATER STORAGE TANK

PART 1 - GENERAL

1.1 SCOPE

- A. The elevated water storage tank shall be designed, constructed, and certified by a qualified tank manufacturer (MANUFACTURER). The MANUFACTURER shall be responsible for all labor, materials and equipment necessary for the design, fabrication, construction, painting, disinfection and testing of an elevated, welded carbon steel water storage tank supported by a steel support pedestal, commonly referred to as a "Pedesphere". Design and construction of the Elevated Tank shall conform to all requirements of AWWA D100 Standard for Welded Carbon Steel Tanks for Water Storage, except as modified by the requirements of these contract documents.
- B. The elevated tank shall be all-welded construction of the most economical design. All members of structural steel or of reinforced concrete shall be designed to safely withstand the maximum stresses to which they may be subjected during erection and operation.
- C. Permits, licenses, airspace authority approval and easements required for the construction of the tank and associated work shall be provided by the OWNER.
- D. The site plan or specifications shall clearly indicate the approximate location of all overhead or underground electrical lines and other utilities and piping. The MANUFACTURER is responsible for coordination and/or relocating or de-energizing any electrical or utility lines that may interfere with the safe construction of the foundation or structure(s). In general, no overhead lines, or supports, shall pass or be located within 50 feet of any part of the structure or the footprint of the tank. A minimum vertical clearance of 15 feet shall be provided along any access routes.
- E. A geotechnical investigation has been carried out at the site and a copy of the report is included with the Appendix to these Contract Documents. Recommendations for the foundation and allowable bearing capacities are defined in this report. The OWNER shall retain the services of the Geotechnical consultant to verify the adequacy of the bearing stratum after the OWNER or MANUFACTURER has carried out the excavation and before any concrete or reinforcement is placed. The concrete foundation shall be designed by the MANUFACTURER based upon the recommendations in the geotechnical report. The report must provide the allowable soil bearing pressure with appropriate factors of safety, the active and passive earth pressure coefficients, the angle of soils internal friction, its cohesion, unit weight and recommendations for bearing depth and backfill requirements.

1.2 QUALIFICATIONS

- A. The design and construction of the “Pedesphere” style water storage tank shall only be undertaken by a MANUFACTURER with a minimum of ten years of experience with elevated tank construction. The MANUFACTURER must be able to demonstrate experience through the design and construction of at least five “Pedesphere” style water tanks. The MANUFACTURER shall not subcontract the design or erection of the steel tank, pedestal and base cone support structure.
- B. As providing a safe work environment is critical for this project, other contractors, and the community, to be approved to bid on this project, given the complexity, and risk associated with the work, all prospective MANUFACTURERS are required to have an Experience Modification Rate (EMR) below 0.70 and a Total Recordable Incident Rate (TRIR) below 2.5 for the last three (3) years. Bidders are required to verify the above requirement by providing with their proposal a statement from their insurance carrier confirming the EMR requirement, and their last three (3) years of OSHA 300 Logs to confirm the TRIR requirement.

1.3 RELATED REQUIREMENTS

- A. Cast-in-Place Concrete: Section 03300
- B. Electrical: Division 16

1.4 SUBMITTALS

- A. The CONTRACTOR shall submit shop drawings to the ENGINEER for review in accordance with Section 01330 for all major equipment and shall have the ENGINEER approve same in writing before ordering the equipment.
- B. Submit copies of materials required to establish compliance with specifications, with provisions of General Conditions. Include at least the following:
 - 1. A list of five “Pedesphere” style elevated tanks constructed within the last five years, including the name of the Owner, tank capacity and the Consulting Engineer.
 - 2. A preliminary drawing of the tank showing major dimensions and plate thickness upon which the bid is based, the high and low water levels and the dimensions of the supporting pedestal and base cone.
 - 3. A foundation design drawing showing preliminary dimensions and approximate quantities of concrete and reinforcing steel.
 - 4. Operation and maintenance manuals in accordance with Division 1.
 - 5. Complete description of the surface preparation and shop prime painting.
- C. After contract award and prior to construction, the CONTRACTOR shall provide engineering drawings and design calculations for the elevated steel tank and the foundation. Drawings shall show the size and location of all structural components and

the foundations along with reinforcement details, the required strength and grade of all materials and the size and arrangement of principle piping and equipment. The drawings and calculations shall bear the certification of a professional Engineer (Delegated Engineer) licensed in the State of Florida. The design coefficients and resultant loads for snow, wind and seismic forces, and the methods of analysis shall be documented.

1.5 QUALITY ASSURANCE

A. Approved Tank Manufacturers

1. Acceptable MANUFACTURERS qualified to perform the work specified herein include:
 - a. Caldwell Tanks
 - b. CB&I Constructors, Inc.
 - c. Landmark Structures
2. The Engineer and / or Owner shall be the sole and final judge as to the acceptability of a MANUFACTURER's qualifications.

B. Quality Assurance

1. Elevated tank design, concrete support structure construction and steel tank construction shall not be subcontracted. These items shall be self-performed by the MANUFACTURER.
2. The MANUFACTURER shall directly employ a full-time professional engineer with a minimum five years cumulative experience in the design and construction of composite elevated tanks. The engineer shall be registered in the State of Florida and shall be in responsible engineering charge of the work.
3. A qualified supervisor directly employed by the manufacturer shall be on site at all times during construction of the foundation, support structure and steel tank.

C. Regulatory Requirements

1. The specifications, codes and standards referenced herein shall govern the work with regard to materials, design, construction, inspection and testing to the extent specified.
2. Personnel safety equipment shall be provided in accordance with OSHA requirements and manufacturers documentation.

1.6 REFERENCE STANDARDS

A. Ensure design, manufacturing, and assembly of elements of the equipment herein specified are in accordance with, but not limited to, published standards of the following, as applicable:

1. AWWA (American Water Works Association) D100 Standard for Welded Carbon Steel Tanks for Water Storage.
2. AWWA D102 - Standard for Painting Steel Water Storage Tanks
3. AWWA C652 - Standard for Disinfection of Water Storage Facilities.

4. AWWA Manual of Water Supply Practices M42 – Steel Water Storage Tanks
5. AWS (American Welding Society) D1.1
6. NSF (National Sanitation Foundation) 61 - Materials in contact with Potable Water.
7. Steel Structures Painting Council Manual - Volume 1 - Good Painting Practice.
8. Steel Structures Painting Council Manual - Volume 2 - Systems and Specifications.
9. ACI 318 - Building Code Requirements for Reinforced Concrete
10. ACI 301 –Specifications for Structural Concrete

- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening applies.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store material to prevent physical damage and theft.
- B. Protect equipment during transportation and installation to avoid damage.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Elevated storage tank(s) shall be constructed as depicted on the Drawings and as describe herein.
1. Tank Hill Elevated Tank
 - a. Size: 500,000 US Gallons
 - b. High Water Elevation: 260 feet
- B. The structural design of the elevated storage tank shall conform to the following design standards except as modified or clarified as follows:
1. Foundations – AWWA D100 and ACI 318 – Building Code Requirements for Reinforced Concrete.
 2. Steel Tank - AWWA D100
 3. Steel Tank Painting – AWWA D102.
- C. Environmental Loads – AWWA D100 and ASCE 7
1. Wind Load
 - a. Wind pressure shall be determined in accordance with AWWA D100, Section 3.1.4. Basic wind speed used in the Wind Pressure formula shall be determined using the mapped site location and Figure 1 of AWWA D100.
 - b. For tanks located in coastal regions, the ENGINEER shall consider the use of an increased basic wind speed as appropriate.
 - c. Wind Speeds are based on Florida Building Code and AWWA D100. Wind speeds used in the final design shall be selected by the Delegated Engineer.
 - 1) Basic Wind Speed (BWS) per AWWA D100 = 116 MPH

- 2) Ultimate Design Wind Speed (V_{ult}) per FBC = 150 MPH
2. Seismic Load
 - a. Seismic loads, if required, shall be comply in accordance with Section 13 of AWWA D100.
 - 1) Region Dependent Transition Period (TL) = 8
 - 2) Site Class E
 - 3) MCE Spectral Response Acceleration at 0.2 sec (S_s) and 1 sec (S_1)
 - a) $S_s = 0.059$
 - b) $S_1 = 0.032$
 - c) Longitude = 82° 12' 33" W (at tank center)
 - d) Latitude = 28° 22' 6" N (at tank center)
 - 4) Importance Factor (IE) = 1.25
3. Snow Load
 - a. Snow load, if required, shall be determined in accordance with AWWA D100, Section 3.1.3.1.

D. Steel Tank

1. The tank and supporting structure shall be of all-welded steel design and construction. All materials, design, fabrication, erection, welding, testing and inspection of the steel tank shall be in accordance with the applicable sections of AWWA D100 except as modified in this document. The tank shall have a spherical shape for capacities of 150,000 gallons and less, and a spheroidal shape for capacities 200,000 gallon and greater.
2. The supporting structure shall be a butt-welded single pedestal having a minimum shaft diameter adequate for the capacity and height of tower. Transition sections at the top and bottom of the pedestal shall be in accordance with the manufacturer's standard. The transition from the base to the pedestal shall be a truncated cone with a compression ring. The transition from pedestal to tank shall be a compression ring with truncated cone for tank capacities 150,000 gallons and less. The transition from pedestal to tank shall be a double-curved smooth knuckle for tank capacities of more than 150,000 gallons.
3. The minimum plate thickness for any part of the structure shall be 3/16 inch for parts not in contact with water and 1/4 inch for parts in contact with water. At junctions in plates where meridional forces are discontinuous such as cone to cylinder junctions or cone to base plate junctions, a tension or compression ring may be required to resist radial forces generated by the discontinuous membrane forces. In these regions, allowable stresses shall not exceed the following stress:
 - a. Tension ring stress shall not exceed the lesser of 15,000 PSI or one half of the minimum specified yield of the plate material.
 - b. Compression ring stresses shall not exceed 15,000 PSI.
 - c. The overturning moment used in designing the pedestal and foundation shall include the moment due to eccentricity of the gravity loads caused by deflection of the structure under wind or seismic conditions (i.e. P-delta effect).

2.2 CONCRETE FOUNDATION

- A. The foundation shall be designed and constructed to safely and permanently support the structure. The basis of the foundation construction shall be consistent with the soils investigation data included herein at the end of these specifications. Appropriate changes to construction schedule and price will be negotiated if, during excavation, soil conditions are encountered which differ from those described in geotechnical report.
- B. The concrete foundation shall be constructed in accordance with ACI 301. Minimum concrete compressive strength shall be as specified in Section 03300, "Cast-In-Place Concrete".

2.3 STEEL TANK CONSTRUCTION

- A. The erection of the steel tank shall comply with the requirements of Section 10 of AWWA D100 except as modified by these documents.
- B. All shop and field welding shall conform to AWS and AWWA D100, Section 10. The contractors shall ensure that the welders or welding operators are qualified in accordance with ASME Section IX or ANSI/AWS B2.1.
- C. All fabrication and shop assembly shall conform to the requirements of AWWA D100, Section 9, Shop Fabrication.
- D. Plates subjected to stress by the weight or pressure of the contained liquid shall be assembled and welded in such a manner that the proper curvature of the plates in both directions is maintained. Plates shall be assembled and welded together by a procedure that will result in a minimum of distortion from weld shrinkage.
- E. Inspection of shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. All inspection shall be performed prior to interior and exterior field painting. Radiographic inspection shall be performed by an independent testing agency with all costs included in the CONTRACTOR's bid and paid by the CONTRACTOR.
- F. All interior lap joints shall be sealed by means of caulking or continuous seal welding. This shall include penetrations of roof accessories.
- G. Surface preparation and coating of all steel surfaces shall be in accordance with Section 09963 "Coating Potable Water Tanks" and AWWA D102.

2.4 ACCESSORIES

- A. The following accessories shall be provided in accordance with these specifications. All items shall be in full conformity with the current applicable OSHA safety regulations and the operating requirements of the structure.
- B. Ladders
 - 1. Access ladders shall be provided at the following locations:
 - a. Grade to upper platform.
 - b. Upper platform to tank floor manhole.
 - c. Upper platform to steel tank roof mounted on access tube interior.
 - d. Exterior of access tube to provide access from the roof manhole to the tank floor.
 - 2. Ladder side rails shall be a minimum 3/8 inch by 2 inches with a 16-inch clear spacing. Rungs shall not be less than 3/4-inch, round or square, spaced at 12-inch centers. The surface of the rungs shall be knurled, dimpled or otherwise treated to minimize slipping.
 - 3. At platforms or landings, the ladder shall extend a minimum of four (4) feet above the platform.
 - 4. Ladders shall be secured to adjacent structures by brackets located at intervals not exceeding ten (10) feet. Brackets shall be of sufficient length to provide a minimum distance of seven (7) inches from the center of the rung to the nearest permanent object behind the ladder.
- C. Fall Protection
 - 1. Ladders shall be equipped with a fall arrest system meeting OSHA regulation.
 - 2. The system shall be supplied complete with safety harnesses, locking mechanisms, lanyards and accessories for two persons.
- D. Upper Platform
 - 1. An upper platform shall be located at the top of the support pedestal to provide access from the pedestal ladder to the roof access ladder located on the interior of the access tube.
 - 2. Platform shall include a 24" x 36" access hatch with opening to allow ladder and safety device to continue 48" minimum above the platform floor.
- E. Roof Handrail
 - 1. A roof handrail shall be provided surrounding the roof manholes, vents and other roof equipment.
 - 2. Handrail shall comply with OSHA requirements.
- F. Condensate Ceiling
 - 1. Steel condensate ceiling located at the junction of the pedestal shaft and base cone complete with drain and 24" x 36" access hatch with opening to allow ladder and safety device to continue 48" minimum above the platform floor.

G. Openings

1. Roof Hatches

a. Primary Access Hatch

- 1) Primary access hatch shall be 30-inch diameter and allow access from the roof to the interior of the tank.
- 2) The hatch opening shall have a minimum 4-inch curb.
- 3) The hatch cover shall be hinged and equipped with a hasp for locking. The hatch cover shall have a 2-inch downward overlap.

b. Secondary Access Hatch

- 1) The secondary access hatch will be 24-inch diameter and allow access from the roof to the interior of the tank.
- 2) Hatch shall be flanged with a removable cover so constructed that an exhaust fan may be connected for ventilation during painting operations.
- 3) The opening shall have a minimum 4-inch curb and equipped with a watertight cover bolted and gasketed to the opening.

c. Access Tube Hatch

- 1) Access Tube Hatch shall consist of one 30-inch diameter hinged access hatch on the access tube roof.
- 2) The hatch opening shall have a minimum 4-inch curb and equipped with a hatch cover with a 2-inch downward overlap.

2. Tank Vent

- a. The tank vent should be centrally located on the tank roof above the maximum weir crest elevation.
- b. The tank vent shall have an intake and relief capacity sufficiently large that excessive pressure or vacuum will not be developed during maximum flow rate. Maximum flow rate should be based on a break in the inlet/outlet pipe when the tank is full.
- c. The vent shall be designed, constructed and screened so as to prevent the ingress of wind driven debris, insects, birds and animals. The vent should be designed to operate when frosted over or otherwise clogged. The screens or relief material shall not be damaged by the occurrence and shall return automatically to operating position after pressure or vacuum is relieved.

3. Tank Floor Manhole

- a. A minimum 18 x 24-inch elliptical access manhole shall be provided in the tank bottom accessible from the upper platform or from a ladder that extends from the platform to the opening.
- b. The hatch shall open inward and be bolted and gasketed to provide a watertight seal.

4. Pedestal Hatch

- a. A 24-inch diameter manhole shall be located near the top of the pedestal for access to the exterior painter's rail located near the tank/pedestal interface. This opening shall be accessible from the upper pedestal platform.

H. Access Tube

1. A minimum 36-inch diameter access tube shall be provided for tanks with capacities of 150,000 gallons and less, or 42-inch diameter access tube on tanks with capacities 200,000 gallons and greater.
 2. The access tube will be provided from the top of the pedestal to the tank roof.
- I. Rigging
1. Interior and exterior rigging devices shall be provided for painting, inspecting and maintaining the structure and accessories.
 2. A continuous bar or tee rail near the top of the exterior support structure shall be provided. The rail may be attached to the support column or steel tank.
 3. A painter's rail attached to the roof, pipe couplings with plugs in the roof or other attachments that provide complete access for painting of tank interior shall be furnished.
- J. Piping
1. Exterior of pipes exposed to stored water shall be coated with tank interior wet system. Exterior of pipes in the pedestal and base cone shall be coated with tank interior dry system.
 2. Inlet/Outlet Piping
 - a. Distribution System Piping
 - 1) Provide a 12-inch diameter standard weight steel inlet/outlet pipe that extends vertically from the base of the pedestal to the bottom of the tank.
 - 2) An expansion joint shall be provided in the vertical section of pipe. The expansion joint should be constructed to accommodate any differential movement caused by settlement or thermal expansion and contraction.
 - 3) Distribution system pipe shall not extend no more than six (6) inches above the LWL.
 - b. Well Riser Piping
 - 1) Provide a 10-inch diameter standard weight steel inlet/outlet pipe that extends vertically from the base of the pedestal to the elevation depicted on the Drawings.
 - 2) An expansion joint shall be provided in the vertical section of pipe. The expansion joint should be constructed to accommodate any differential movement caused by settlement or thermal expansion and contraction.
 - c. Piping greater than eight (8) inches shall be equipped with stainless steel cages or bars protecting the safety of workers inside the tank. Cages or bars shall be approved by ENGINEER.
 3. Overflow
 - a. The overflow pipe shall be designed to carry the maximum design flow rate of 1,000 GPM. The steel overflow pipe will be 8-inch in diameter and shall have a minimum wall thickness of ¼-inch.
 - b. A suitable weir shall be provided with the crest at High Water Level.
 - c. The overflow pipe shall extend down from the weir box through the tank, pedestal, and base cone.

- d. The overflow pipe shall penetrate the base cone wall approximately 1 to 2 feet above grade and discharge onto a concrete splash pad or drainage structure.
 - e. The point of discharge shall have a 45-degree elbow and be equipped with a stainless-steel screened end.
- K. Interior Floor
 - 1. A concrete slab-on-grade shall be provided inside the base cone.
 - 2. The floor shall have a minimum thickness of 6-inches and reinforced with 6x6/W2.9 x W2.9 WWF.
 - 3. Isolation joints shall be provided at junctions with walls, columns, equipment or piping foundations.
- L. Personnel Door
 - 1. A 36-inch by 80-inch access door with a flush threshold shall be located in the base of the pedestal cone.
 - 2. A step over threshold is not acceptable.
 - 3. The door shall be fabricated from steel plate with adequate stiffening and specifically designed for use with the tank. The access door will be equipped with handle, drip cover and dead bolt lock.
 - 4. Commercial hollow metal doors and frames are not acceptable.
- M. Identification Plate
 - 1. A tank identification plate shall be mounted near the personnel door.
 - 2. The identification plate shall be corrosion resistant and contain the following information.
 - a. Manufacturer
 - b. Contractor Name
 - c. Contractor's Project or File Number
 - d. Tank Capacity
 - e. Height to High Water Level
 - f. Date Erected

PART 3 - EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall see that all items of equipment are installed, piped, and wired in accordance with the MANUFACTURER's recommendations and shall place all equipment in satisfactory operation. The equipment shall be checked by a MANUFACTURER's representative to be sure that it has been installed in compliance with recommendations.
- B. All work shall be tested and subject to final approval of the ENGINEER.

3.2 FOUNDATION

A. Excavation

1. The foundation bearing surface and excavation shall be inspected by a representative of the geotechnical engineer prior to foundation construction. Verification of the applicable design and construction recommendations is required. The geotechnical engineer shall be retained by the CONTRACTOR or MANUFACTURER. After verification of the foundation bearing surface, provide a two-inch thick concrete working slab within the lower excavation limits.
2. If conditions are encountered that change the design parameters, appropriate changes will be made to construction schedule and compensation.
3. Grade the site to prevent runoff from entering the excavation.

B. Concrete Construction

1. Concrete construction shall be in accordance with the requirements of ACI 301.
2. Reinforcement placed adjacent to a concrete working slab shall have a two inch minimum cover.
3. Earth cuts shall not be used as forms for vertical surfaces.

C. Finish

1. Formed surfaces shall have a smooth form finish when exposed and a rough form finish when not exposed.
2. Unformed surfaces shall have a trowel finish when exposed and floated finish when not exposed.

3.3 STEEL TANK AND PEDESTAL

A. Welding

1. Welding procedures and general welding requirements shall be in accordance with AWWA D100, Section 8 - Welding.
2. Grinding of weld contour shall approximate Condition "D" of NACE Standard RP0178.

B. Fabrication

1. Layout, cutting, forming, edge preparation and workmanship for steel tank components and fabrications shall be in accordance with AWWA D100, Section 9 - Shop Fabrication.

C. Tank Erection

1. Steel tank erection procedures and general requirements shall be in accordance with AWWA D100, Section 10 - Erection.

D. Tolerances

1. Tolerances shall be in accordance with AWWA D100.
2. Plates shall be fabricated and erected such that the proper curvature is maintained.
3. Weld procedures employed shall minimize distortion.

- E. Grouting
 - 1. The interface between the steel tank base plate and the supporting structural concrete foundation shall be constructed with a minimum 1-¼ inch void.
 - 2. The void shall be filled with a flowable or packable non-shrink grout mix in accordance with the manufacturers' requirements.

3.4 FIELD QUALITY CONTROL

- A. Concrete Testing and Inspection
 - 1. The evaluation and acceptance of concrete shall be in accordance with ACI 318.
- B. Steel Tank Testing & Inspection
 - 1. Inspection procedures for the steel tank shall be as required by AWWA D100, Section 11 - Inspection.
 - 2. Radiographic inspection of full penetration butt-welded joints shall be made by an independent inspection company retained by the CONTRACTOR.
- C. Reports and Certifications
 - 1. Provide a certified copy of a tank inspection report per AWWA D100.

3.5 CLEANING

- A. The project site shall be kept in a clean and safe condition at all times. The MANUFACTURER shall remove all construction equipment and debris at project completion.
- B. Tank Disinfection
 - 1. Water and sufficient pressure for flushing, cleaning, initial testing and disinfection shall be supplied by the OWNER at no cost to the CONTRACTOR.
 - 2. Disinfection shall be in accordance with AWWA C652.
 - 3. Tank leakage test shall be performed during disinfection.

3.6 WARRANTY

- A. The MANUFACTURER shall guarantee its work for a period of one year from the completion date defined in the contract documents to the extent that it will repair any defects caused by faulty design, workmanship or material furnished under the specifications. If CONTRACTOR is not advised of any defects within 30 days of end of guarantee period, guarantee shall be considered fulfilled and complete. Defects caused by damaging service conditions such as electrolytic, chemical, abrasive or other damaging service conditions are not covered by this guarantee.

- B. All guarantees obtained by the MANUFACTURER from the manufacturer or installer of paint, equipment or accessories not manufactured by MANUFACTURER shall be obtained for the benefit of the Purchaser.

END OF SECTION 13211

SECTION 13300

INSTRUMENTATION AND CONTROLS – GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall procure the services of a Process Control System Supplier (PCSS) to furnish and install all materials, equipment, labor and services, required to achieve a fully integrated and operational system as specified herein, in the Specification Sections listed below, and in related drawings, except for those services and materials specifically noted.
 - 1. 13302 - Instrumentation and Controls – Testing
 - 2. 13303 - Instrumentation and Controls – Training
 - 3. 13305 - Instrumentation and Controls - Control Descriptions
 - 4. 13306 - Instrumentation and Controls - Application Engineering Services
 - 5. 13330 - Instrumentation and Controls – Control Panels, Enclosures and Panel Mounted Devices
 - 6. 13340 - Instrumentation and Controls – Instruments
 - 7. 13341 - Instrumentation and Controls - Flow Devices
 - 8. 13343 - Instrumentation and Controls – Pressure Devices
 - 9. 13345 - Instrumentation and Controls - Analytical Devices
- B. Items specifically excluded from the scope include the following:
 - 1. N/A
- C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, shall be included whether they are shown on the Drawings or not.
- D. All equipment and installations shall satisfy applicable Federal, State and local codes.
- E. Use the equipment, instrument, and loop numbering scheme shown on the Drawings and specifications in the development of the submittals. Do not deviate from or modify the numbering scheme without the Engineer's approval.

1.2 RELATED WORK

- A. Instrumentation and Controls conduit systems are specified in Section 16110.
- B. Instrumentation signal cable and alarm and status wiring are specified in Section 16120.

- C. Relevant equipment sections in Division 11, 13, and 15.

1.3 SUBMITTALS

A. General Requirements:

1. Refer to Section 01300 for general submittal requirements.
2. Shop drawings shall demonstrate that the equipment and services to be furnished comply with the provisions of these specifications and shall provide a complete record of the equipment as manufactured and delivered.
3. Submittals shall be complete; giving equipment specifications, details of connections, wiring, ranges, installation requirements, and specific dimensions. Submittals consisting of only general sales literature shall not be acceptable.
4. Substitutions on functions or type of equipment specified shall not be acceptable unless specifically noted.
5. Separate submittals shall be made for each submittal listed below.

B. Qualifications Submittal

1. Submit, within 30 calendar days after Notice to Proceed, detailed information on staff and organization to show compliance with the Quality Assurance requirements of this Section. The Qualifications submittal shall be submitted and approved before any further submittals will be accepted. Failure to meet the minimum requirements shall be grounds for rejection as a PCSS. The Qualifications Submittal shall, as a minimum, contain the following:
 - a. Copies of ISA CCST Level 1 certificates for all field technicians or resumes demonstrating field experience.
 - b. Copy of UL-508 certificate for panel fabrication facilities.
 - c. Project references for water or wastewater projects as defined in the Quality Assurance paragraphs.
 - d. Documentation to demonstrate the ability to complete this project including: resumes of key staff, details on engineering, design, fabrication, and field service capacity, and location of staff responsible for responding to the site within four hours to resolve startup issues.

C. Project Plan, Deviation List, and Schedule Submittal

1. Submit, within 45 calendar days after Notice to Proceed, a Project plan. The Project Plan shall be submitted and approved before further submittals shall be accepted. The Project Plan shall, at a minimum, contain the following:
 - a. Overview of the proposed control system describing the understanding of the project work, a preliminary system architecture drawing, interfaces to other systems, schedule, startup, and coordination. A discussion of startup, replacement of existing equipment with new, switchover (Maintaining Plant Operations during system transition), approach to testing and training, and other tasks as required by these specifications shall be included as applicable.
 - b. Preliminary list of HMI software, PLC software, and PLC hardware, including version numbers, solely to determine compliance with the requirements of the Contract Documents prior to beginning development of

system programming. Review and approval of software and hardware systems as part of this Project Plan stage shall not relieve the PCSS of meeting all the functional and performance requirements of the system as specified herein. Substitution of manufacturer or model of these systems after the submittal is approved is not allowed without Engineer approval.

- c. Project personnel and organization including the PCSS project manager, project engineer, and lead project technicians. Include resumes of each these individuals and specify in writing their commitment to this project. These do not need to be submitted again if already submitted in the Qualification submittal.
 - d. Sample formats of the shop drawings to be submitted and in conformance with the requirements of the Specifications. At a minimum include samples of panel fabrication drawings, loop, and I/O wiring diagrams.
2. Exceptions to the Specifications or Drawings shall be clearly defined in a Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the Engineer. If no exceptions are taken to the specifications or drawings the PCSS shall make a statement as such. If there is no statement by the PCSS, then it is acknowledged that no exceptions are taken.
3. Project schedule shall be prepared in Gantt chart format clearly showing task linkages for all tasks and identifying critical path elements. PCSS schedule must be based on the General Contractor schedule and must meet all field installation, testing, and start-up milestones in that schedule. The project schedule shall illustrate I&C related major project milestones including the following:
- a. Schedule for all subsequent project submittals. Include the time required for Contractor submittal preparation, Engineer's review time, and a minimum of two complete review cycles.
 - b. Proposed dates for all project coordination meetings.
 - c. Hardware purchasing, fabrication, and assembly (following approval of related submittals).
 - d. Shipment of instrument
 - e. Installation of instrument and control system equipment.
 - f. Testing: Schedule for all testing.
 - g. Schedule for system cutover, startup, and/or going on-line for each major system.
 - h. Schedule for all training including submittal and approval of O&M manuals, factory training, and site training.
- D. Input/Output (I/O) List Submittal
- 1. Submit, within 60 days after Notice to Proceed, a complete system Input/Output (I/O) address list for equipment connected to the control system under this Contract.
 - 2. I/O list shall be based on the P&ID's, the Drawings, the design I/O list (if included), and requirements in the Specifications.
 - 3. The I/O list shall be submitted in both a Microsoft Excel readable electronic file format and an 8-1/2 inch by 11-inch hard copy.

4. The I/O list shall reflect all active and spare I/O points. Add points to accommodate spare I/O as required in the specifications.
 5. The I/O list shall be arranged such that each control panel has a dedicated worksheet. At a minimum, I/O worksheet shall include the following information
 - a. TAG NUMBER(S): As indicated on the drawings, the identifier assigned to a device that performs a function in the control system. As part of this information, the loop number of the tag shall be broken out to allow for sorting by loop.
 - b. DESCRIPTION: A description of the function of the device (text that includes signal source, control function, etc.) Include the text "Spare Points" for all I/O module points that are not connected to equipment.
 - c. PHYSICAL LOCATION: The Control Panel designation of where the I/O point is wired to.
 - d. Physical POINT ADDRESS: Rack, Slot, and Point (or Channel) assignment for each I/O point.
 - e. I/O TYPE: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, or PO – Pulse Output.
 - f. RANGE/STATE: The range in engineering units corresponding to an analog 4-20 mA signal, or, the state at which the value of the discrete points are "1."
 - g. ENGINEERING UNITS: The engineering units associated with the Analog I/O.
 - h. ALARM LIMITS: Include alarm limits based on the control descriptions and the Drawings.
 - i. P&ID – the P&ID or drawing where the I/O point appears on. Mark as "NA" (Not Applicable) if the I/O point is derived from a specification requirement and is not on the P&IDs.
 6. The I/O list shall be sorted in order by:
 - a. Physical location
 - b. I/O Type
 - c. Loop Number
 - d. Device Tag
 7. Once the I/O list is approved, the PLC I/O addresses shall not be modified without approval by the Engineer.
 8. For I/O layout requirements, see the PLC Section 13311.
- E. Field Instruments Submittal
1. Refer to the Instruments section for submittal requirements.
- F. Hardware and Software Packages Submittal
1. N/A
- G. Panel Layout Drawings and Wiring Diagrams Submittal
1. Refer to the Control Panels section for submittal requirements.
- H. Testing Plan Submittals
1. Refer to the 13302 Testing section for specific testing submittal requirements.

- I. Training Plan Submittals
 - 1. Refer to Section 13303 for specific training requirements.
- J. Spares, Expendables, and Test Equipment Lists Submittal
 - 1. Submit a list of, and descriptive literature for, spares, expendables, and test equipment.
 - 2. Submit a list of, and descriptive literature for, additional spares, expendables, and test equipment recommended by the manufacturer.
 - 3. Submit unit and total costs for the additional spare items specified or recommended for each subsystem.
- K. Operations and Maintenance (O&M) Manuals
 - 1. Submit in accordance with section 01730.
 - 2. Furnish O&M manuals as specified herein. If the PCSS is performing the AE work, provide AE Manuals as specified in Section 13306.
 - 3. The operations and maintenance manuals shall, at a minimum, contain the following information:
 - a. Table of Contents
 - 1) A Table of Contents shall be provided for the entire manual with the specific contents of each volume clearly listed. The complete Table of Contents shall appear in each volume.
 - b. Instrument and Equipment Lists
 - 1) The following lists shall be developed in Microsoft Excel format and provided not only as a hardcopy in O&M but also electronically on a CD.
 - 2) An instrument list for all devices supplied including tag number, description, specification section and paragraph number, manufacturer, model number, serial number, range, span, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
 - 3) An equipment list for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
 - c. Equipment Operations and Maintenance Information
 - 1) ISA-TR20.00.01-2001(updated in 2004-2006) data sheets shall be provided for all field instruments. For non-field instrumentation devices, provide a cover page for each device, piece of equipment, and OEM software that lists date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA-TR20.00.01-2001(updated in 2004-2006), general data sheet; however, other formats will be acceptable provided they contain all required information
 - 2) Vendor O&M documentation for each device, piece of equipment, or OEM software shall be either new documentation written specifically for this project, or modified standard vendor documentation. All

- standard vendor documentation furnished shall have all portions that apply clearly indicated with arrows or circles. All portions that do not apply shall be neatly lined out or crossed out. Groups of pages that do not apply at all to the specific model supplied shall be removed.
- 3) Provide the record documentation of the system audit as specified in the 13302 Testing section.
 - 4) Include the calibration forms developed as specified in the 13302 Testing section.
- d. As-Built Drawings
- 1) Complete as-built drawings, including all drawings and diagrams specified in this section under the "Submittals" section. These drawings shall include all termination points on all equipment the system is connected to, including terminal points of equipment not supplied by the PCSS.
 - 2) As built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.
- e. Original Licensed Software
- 1) Submit original software diskettes or CD-ROMs of all software provided under this Contract. Submit original paper based and electronic documentation for all software provided. Submit license agreement information including serial numbers, license agreements, User Registration Numbers and related information. All software provided under this Contract shall be licensed to the Owner at the time of purchase. Provide media in software sleeves within O&M manual.
- f. Electronic O&M Information
- 1) In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals and data sheets, along with any software back-up of configuration files, on CDROM or DVD. Electronic documents shall be supplied in Adobe Acrobat format.
 - 2) Provide electronic files for all custom-developed manuals including training manuals. Text shall be supplied in both Microsoft Office format and Adobe Acrobat format.
 - 3) Provide electronic files for all drawings produced. Drawings shall be in AutoCAD ".dwg" format and in Adobe Acrobat format. Drawings shall be provided using the AutoCAD eTransmit feature to bind external references, pen/line styles, fonts, and the drawing file into individual zip files.
 - 4) Each computer system hardware device shall be backed up onto CDROM or DVD after Substantial Completion and shall be turned over to the Owner.
 - 5) If specified in the training section, provide digital copies of all training videos. Videos shall be in a format that is readable by standard DVD

players and by standard PC DVD drives. Format shall be a minimum of 800 by 600 pixels and shall include sound.

4. The cover and edge of each volume shall contain the information as specified in 01730.

1.4 COORDINATION MEETINGS

- A. Schedule the mandatory coordination meetings as described herein. The meetings shall be held at the Owner's designated location and shall include attendance by the Owner, the Engineer, the Contractor, the PCSS's Project Engineer, and the AESS Project Engineer, if applicable. Other Division 13 specifications may require additional meetings. Prepare and distribute an agenda for this meeting a minimum of one week before the scheduled meeting date. Meeting shall be scheduled a minimum of one week before the requested meeting date.
 1. A project kickoff coordination meeting shall be held within two weeks after submitting the Project Plan. The purpose of the meeting shall be to discuss the PCSS's Project Plan, to summarize the PCSS's understanding of the project; discuss any proposed substitutions or alternatives; schedule testing and delivery deadline dates; provide a forum to coordinate hardware and software related issues; and request any additional information required from the Owner. The meeting will last up to one business day.
 2. A submittal review coordination meeting shall be held after the Hardware, Panel Drawing, and Loop Drawing Submittal package has been reviewed by the Engineer and returned to the PCSS. The purpose of this meeting shall be to review comments made on the submittal package; to refine scheduled deadline dates; coordinate equipment installation activities; and provide a forum for any further required coordination between the PCSS and AESS. The meeting will last up to one business day.
 3. Regular on-site meetings when the PCSS staff is at the plant site.

1.5 REFERENCE STANDARDS

- A. Publications are referred to in the text by basic designation only. Where a date is given for reference standards, that edition shall be used. Where no date is given for reference standards, the latest edition in effect at the time of bid opening shall apply.
- B. International Society of Automation (ISA)
 1. ISA S5.2, Binary Logic Diagrams for Process Operations
 2. ISA S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation Logic and Computer Systems.
 3. ISA S5.4 Instrument Loop Diagrams.
 4. ISA S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
 5. ISA RP60.3, Human Engineering for Control Centers
 6. ISA RP60.6, Nameplates, Labels, and Tags for Control Centers

- 7. ISA-99, Industrial Automation and Control Systems Security
- C. National Electrical Manufacturers Association (NEMA)
- D. National Fire Protection Agency (NFPA)
 - 1. NFPA 70, National Electrical Code (NEC).
 - 2. NFPA 79, Industrial Control Equipment.
- E. Underwriters Laboratories, Inc. (UL)
 - 1. UL 508 - Industrial Control Equipment - for custom fabricated equipment
 - 2. A nationally recognized testing laboratory, as approved by the Authority having jurisdiction, may substitute for UL listing on commercial off the shelf products.

1.6 QUALITY ASSURANCE

- A. The Process Control System Supplier (PCSS) shall be a "systems integrator" regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a "systems integrator" shall be interpreted to mean an organization that complies with all of the following criteria:
 - 1. Employs personnel on this project who have successfully completed ISA or manufacturers training courses on general process instrumentation and configuration and implementation of the specific programmable controllers, computers, and software proposed for this project. Key personnel shall hold ISA CCST Level 1 certification or have a minimum of 10 years of verifiable plant startup experience. Key personnel shall include, as a minimum, the lead field technician.
 - 2. Has successfully completed work of similar or greater complexity on at least three previous projects within the last five years. Successful completion shall be defined as a finished project completed on time, without any outstanding claims or litigation involving the PCSS. Potential references shall be for projects where the PCSS's contract was of similar size to this project.
 - 3. Has been actively engaged in the type of work specified in this Specification Section for a minimum of five years.
- B. The PCSS shall maintain a permanent, fully staffed and equipped service facility within 200 miles of the project site with full time employees capable of designing, fabricating, installing, calibrating, and testing the systems specified herein. At a minimum, the PCSS shall be capable of responding to on-site problems within 12 hours of notice. Provide an on-site response within 4 hours of notification starting at two months before scheduled startup to two months after startup completion.
- C. PCSS shall hold a valid UL-508 certification for their panel fabrication facility.
- D. Actual installation of the instrumentation system need not be performed by the PCSS's employees; however, the PCSS as a minimum shall be responsible for the technical

supervision of the installation by providing on site supervision to the installers of the various components.

- E. The selected PCSS shall be one of the following:
 - 1. Curry Controls Company,
 - 2. Revere Control Systems,
 - 3. DCR Engineering Services, Inc.,
 - 4. Or approved equal.
- F. Application Engineering (AE) as specified in section 13306 Application Engineering Services shall be provided by the following, no exceptions:
 - 1. Data Flow Systems, Inc.
- G. Being listed in this specification does not relieve any potential PCSS from meeting the qualifications specified in this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage, and handling shall be in accordance with Section 01600.
- B. Shipping Precautions
 - 1. After completion of shop assembly, factory test and approval of all equipment, cabinets, panels and consoles shall be packed in protective crates and enclosed in heavy duty (5 mil) polyethylene envelopes or secured sheeting to provide protection from damage, dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at the job site.
 - 2. Manufacturer's special instructions for field handling, storage and installation required for protection, shall be securely attached to the packaging for each piece of equipment prior to shipment. The instructions shall be stored in resealable plastic bags or other means of protection.
 - 3. None of the HMI control and monitoring equipment shall be shipped to the site until the control room areas comply with specified ambient temperature and humidity. Have qualified personnel accept the equipment on delivery and supervise unloading within the control room areas.
 - 4. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the owner.

1.8 NOMENCLATURE AND IDENTIFICATION

- A. Field Instrument Tags
 - 1. See Section 13340.
- B. Panel Nameplates

1. See Section 13330.

1.9 WARRANTY

- A. Provide warranty per Section 01740, Warranties and Bonds, and as specified herein.

1.10 MAINTENANCE CONTRACT

- A. A written proposal for a maintenance contract executed by the PCSS shall be provided to the Owner for on-site preventive maintenance services related to the Instrumentation and Control system. The cost of this maintenance contract shall not be included in the Contract Price.
- B. This proposal shall be provided within 30 days after final acceptance for the purpose of entering a contract for annual maintenance subsequent to the first year of maintenance. Standard per diem rates for providing breakdown service shall be set forth in the contract. Such rates shall be fair and reasonable and reflect the lowest rates offered to most favored customers. The fee quoted shall be firm for a minimum of 90 days from date of issue.
- C. This maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 24 hours, to provide complete system maintenance for a period of one year after the date of Substantial Completion of the system for all equipment and software provided as part of the PCSS scope of work.
- D. Provide software updates throughout the maintenance contract period. Provide latest official released version for all software provided under this Contract. Owner shall have the latest software releases at the end of the maintenance contract period.
- E. The maintenance contract shall also include a minimum of 4 preventive maintenance visits by qualified service personnel of the Supplier who is familiar with the type of equipment provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning and lubrication of system equipment and verification of correct operation.
- F. Visits to the sites to correct deficiencies under warranty shall not be included in this preventive maintenance service contract.
- G. Emergency maintenance procedures or plant visits may coincide with a preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The Supplier shall have full responsibility for the system hardware preventive and corrective maintenance.
- H. During the one-year maintenance period, observation of maintenance operations by plant personnel and the instruction of said personnel in the details of the maintenance work being performed, shall be provided.

1.11 PROJECT/SITE REQUIREMENTS

- A. Environmental Requirements. Refer to Section 16000 and Electrical Drawings for specific environmental and hazardous area classifications.
- B. Elevation: Equipment shall be designed to operate at the project ground elevation.
- C. Temperature:
 - 1. Outdoor areas' equipment shall operate [between -30 to 50 C degrees ambient].
 - 2. Equipment located in indoor locations shall operate between [10 to 35 C] degrees ambient minimum.
 - 3. Storage temperatures shall range from [0 to 50 C] degrees ambient minimum.
 - 4. Additional cooling or heating shall be furnished if required by the equipment as specified herein.
- D. Relative Humidity. Air conditioned area equipment shall operate between 20 to 95 percent relative, non-condensing humidity. All other equipment shall operate between 5 to 100 percent relative, condensing humidity.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All instrumentation and electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and epoxy or approved equal coating to prevent contamination by dust, moisture and fungus. The field mounted equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.
- B. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks unless otherwise noted. Fasteners for securing control panels and enclosures to walls and floors shall be either hot-dipped galvanized after fabrication or stainless steel. Provide stainless steel fasteners only in corrosive areas rated NEMA 4X on the Drawings or as defined under Section 16000. Provide minimum size anchor of 3/8-inch.
- C. All indicators shall be linear in process units, unless otherwise noted. All transmitters shall be provided with indicators in process units, accurate to two percent or better.
- D. All equipment, cabinets and devices furnished shall be heavy-duty type, designed for continuous industrial service. The system shall contain similar products of a single manufacturer, and shall consist of equipment models, which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.
- E. All electronic/digital equipment shall be provided with radio frequency interference protection.

F. Electrical

1. Equipment shall operate on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
2. With the exception for field device network connected devices, all electronic instrumentation shall utilize linear transmission signals of isolated 4 to 20 mA DC (milliampere direct current) capable of driving a load up to 750 ohms, unless specified otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).
3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed.
4. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless noted otherwise.
5. Switches and/or signals indicating an alarm, failure or upset condition shall be wired in a fail-safe manner. A fail-safe condition is an open circuit when in an alarm state.
6. Materials and equipment shall be UL approved whenever such approved equipment and materials are available.
7. All equipment furnished shall be designed and constructed so that in the event of power interruption, the systems specified herein shall go through an orderly shutdown with no loss of memory, and shall resume normal operation without manual resetting when power is restored, unless otherwise noted.

2.2 ELECTRICAL SURGE PROTECTION

- A. General - Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level. Protection shall be maintenance free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an $8 \times 20 \mu\text{s}$ impulse waveform) of at least 8 kA. Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground in accordance with Section 16660.
- B. Provide protection of all analog signal (4-20 mA) circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Protection devices located near the transmitter shall be mounted in a separate NEMA 4X stainless steel enclosure (plastic is not acceptable) or conduit mounted, and shall be Phoenix Contact PT Series, MTL Surge Technologies (Telematic) TP48, Citel TSP-10 series, or equal. Substitution of a single device to protect both 120 VAC and 4-20 mA wires to an instrument is acceptable. Protection devices in

control panels shall be MTL Surge Technologies (Telematic) SD Series, Phoenix Contact PT Series, Citel DLA series, or approved equal.

- C. Provide protection of all 120 VAC power feeds into control panels, instruments, and control room equipment. Surge arresters shall be Transtector ACP-100BW Series, Phoenix Contact "Mains-PlugTrab", MCG Surge Protection 400 Series, Citel DS40 series, or approved equal.
- D. Non-Fiber Based Data Highway or Communications Circuits – Provide protection on all communication and data highway circuits that leave a building or are routed external to a building. Circuit protection shall be provided at both ends of the line. Surge protection devices shall be Phoenix Contact PlugTrab Series, Transtector FSP Series, MTL Surge Technologies (Telematic) NP Series, Citel DLA series or MJ8 series, or approved equal.
- E. RF Coaxial Cable – Provide protection on communication cables between radios and antennas, mounted either inside the panel, or in the wall of the enclosure in accordance with NEMA and UL standards. Surge protection devices shall be Citel P8AX series, Polyphaser, or approved equal.
- F. Inductive Loads – Provide coil surge suppression devices, such as varistors or interposing relays, on all process controller outputs or switches rated 120 VA or less that drive solenoid, coil, or motor loads.
- G. Telephone Circuits - At a minimum, provide Telephone Company approved line protection units for all telephone lines used for telemetry or SCADA system use under this Contract.

2.3 SPARE PARTS

- A. All spare parts shall be wrapped in bubble wrap, sealed in a polyethylene bag complete with dehumidifier, then packed in cartons and labeled with indelible markings. Complete ordering information including manufacturer's contact information (address and phone number), part name, part number, part ordering information, and equipment name and number(s) for which the part is to be used shall be supplied with the required spare parts. The spare parts shall be delivered and stored in a location directed by the Owner or Engineer.
- B. Furnish one of each type of installed Surge protection devices.
- C. Other spare parts are specified in each section. An overview follows:
 - 1. Instrument related Spare Parts - see the Instrument section(s).

2.4 TEST EQUIPMENT

- A. Provide all test equipment, instruction manuals, carrying/storage cases, unit battery charger, special tools, calibration fixtures, cord extenders, patch cords, test leads, and miscellaneous items for checking field operation of all supplied equipment.
- B. All test equipment shall be wrapped in bubble wrap, sealed in a polyethylene bag with a dehumidifier, then packed in cartons and labeled with indelible markings. Complete ordering information including manufacturer's part number, and equipment name shall be supplied. The test equipment shall be delivered and stored in a location directed by the Engineer.
- C. As a minimum, furnish the following test equipment:
 - 1. N/A

2.5 GENERAL INSTALLATION

- A. Instrumentation and accessory equipment shall be installed in accordance with manufacturer instructions. The indicated locations of equipment, transmitters, alarms and similar devices indicated are approximate only. Exact locations of all devices shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control equipment and in case of interference with other work, proceed as directed by the ENGINEER and furnish all labor and materials necessary to complete the work in an approved manner at no additional cost to the Owner.
- B. Provide brackets and hangers required for mounting of equipment.
- C. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.
- D. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, ship material in sections sized to permit passing through restricted areas in the building. Provide on-site service to oversee the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer's approval. Certify that field wiring associated with the equipment is installed in accordance with best industry practice. Coordinate work under this section with that of the electrical work specified under applicable Sections of Division 16.
- E. Provide sunshades for equipment mounted outdoors in direct sunlight. Sunshades shall include standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North or as required to minimize the impact of glare and ultraviolet exposure on digital readouts.

2.6 TESTING

- A. Refer to Section 13302.

2.7 TRAINING

- A. Refer to Section 13303.

END OF SECTION 13300

SECTION 13302

I&C – TESTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to complete the testing of all devices and systems furnished and installed as detailed on the Drawings, and as specified herein.
- B. Refer to Section 13300 for other general requirements.

1.2 RELATED WORK

- A. Refer to Section 13300.
- B. Division 1 "Equipment Testing and Start-up" section

1.01 SUBMITTALS

- C. Refer to Section 13300.
- D. Testing Submittals - Submit, in one submittal, the following testing related documents:
 - 1. Status signoff forms
 - a. Develop and submit project specific I/O Status and Automatic Control Strategy signoff forms to be used during factory and field testing to organize and track each loop's inspection, adjustment, calibration, configuration, and testing status and sign off. Include sign-off forms for each testing phase showing all loops.
 - 1) Example forms are shown in the Appendices.
 - 2) Separate forms for factory and field testing can be used, or they can be combined, at the discretion of the PCSS.
 - 3) Submit testing forms prior to start of testing.
 - 2. Testing Procedures
 - a. Submit detailed procedures proposed to be followed for each of the tests specified herein. The test procedures shall serve as the basis for the execution of the required tests to demonstrate that the system meets and functions as specified.
 - b. The documents shall be structured in an orderly and easy to follow manner to facilitate an efficient and comprehensive test.
 - c. The test procedures shall indicate all pre-testing setup requirements, all required test equipment, and simulation techniques to be used.

- d. The test procedures shall be structured in a cause and effect manner where the inputs are indicated, and the outputs are recorded.
- e. The test procedures shall include the demonstration and validation under normal operating conditions and under various failure scenarios as specified in the contract documents.
- f. Testing may not start until all Testing Submittals have been approved.

E. Test Documentation

- 1. Upon completion of each required test, document the test by submitting a copy of the signed off Testing Status forms. Testing shall not be considered complete until the signed-off forms have been submitted and approved. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

1.3 MAINTENANCE

- A. Refer to Section 13300.

1.4 NOT USED

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TESTING - GENERAL

- A. Refer to Section 13300.
- B. The results of all testing shall be tracked on a project specific status sign off form or similar document. The PCSS shall be responsible for maintaining the sheet. The Appendix of this section has an example template for this sheet.
- C. The tests the PCSS is required to perform are as follows:
 - 1. Factory Testing
 - a. N/A
 - 2. Field Testing
 - a. Operational Readiness Test (ORT).
 - b. Functional Demonstration Test (FDT).
 - c. Startup Acceptance Test (SAT).
- D. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide all special testing materials and equipment required for a suitable means of simulation.

- E. The PCSS shall coordinate all required testing with the Contractor, all affected Subcontractors, the Engineer, and the Owner.
- F. The Engineer reserves the right to test or re-test any functions.
- G. Correction of Deficiencies
 - 1. All deficiencies in workmanship and/or items not meeting specified testing requirements shall be corrected to meet specification requirements at no additional cost to the Owner.
 - 2. Testing, as specified herein, shall be repeated after correction of deficiencies is made until the specified requirements are met. This work shall be performed at no additional cost to the Owner.

3.2 FACTORY TESTING - UNWITNESSED FACTORY TEST (UFT)

- A. N/A

3.3 FACTORY TESTING - WITNESSED FACTORY TEST (WFT)

- A. N/A

3.4 FIELD TESTING - OPERATIONAL READINESS TEST (ORT)

- A. The purpose of the ORT is to check that the process equipment, instrument installation, instrument calibration, instrument configuration, field wiring, control panels, and all other related system components are ready to monitor and control the processes. This test will determine if the equipment is ready for operation.
- B. This test shall take place prior to FDT and startup. Prior to starting this test, relevant process equipment shall be installed and mechanically tested, instruments installed, control panels installed, and field wiring complete.
- C. Required Documents for Test
 - 1. Master copy of the PCSS developed field testing signoff forms.
 - 2. Testing procedures.
 - 3. Calibration forms.
- D. These inspections, calibrations, and tests do not require witnessing. However, the Engineer may review and spot-check the testing process periodically. Any deficiencies found shall be corrected by the PCSS prior to commencement of the Functional Demonstration Test.
- E. The PCSS shall maintain the Sign-off forms and the Calibration forms at the job site and make them available to the Engineer/Owner at any time.
- F. The following tests shall be performed as part of the ORT:

1. Instrument calibration, configuration, and set-up.
2. Input/Output (I/O) Testing to the HMI and OITs.
3. Testing of control strategies.

G. Instrument calibration, configuration, and set-up

1. Calibrate, configure, and set-up all components and instruments to perform the specified functions.
2. Calibration form
 - a. For any component or instrument requiring dip switch settings, calibration, or custom configuration, maintain a calibration form in the field documenting this information. These forms shall provide a summary of the actual settings used in the field to allow an Instrument technician to replace the device entirely and configure it to function as it did before.
 - b. This information shall be added to the Instrument data sheet, shall be added to a copy of the manufacturer's standard "Configuration Sheet", or a separate form shall be created.
 - 1) If a separate form, the form shall list the Project Name, Loop Number, ISA Tag Number, I/O Module Address, Manufacturer, Model Number/Serial Number, Output Range and Calibrated Value.
 - c. Some examples of required information are:
 - 1) For Discrete Devices: Actual trip points and reset points.
 - 2) For Instruments: Any configuration or calibration settings entered into instrument
 - 3) For Controllers: Mode settings (PID).
 - 4) For I/O Modules: Dip switch settings, module configuration (if not documented in the native programming documentation).
 - d. Maintain a copy of these forms in the field during testing, and make them available for inspection at any time.
 - e. For any device that allows a software back-up of configuration files to a laptop, make the configuration files available to the Engineer/Owner for inspection. Submit as part of the Final System Documentation as specified in Section 13300.

H. I/O Testing

1. The purpose of the I/O testing is to check that the process equipment, instrument installation, calibration, configuration, field wiring, and the control panels are set-up correctly to monitor and control the processes. This test is commonly referred to as a "loop test" or an I/O checkout.
2. PCSS in conjunction with the contractor shall test signals under process conditions. The preferred test method will always be to execute the test wherever possible to the end elements. For example, the preferred test will prove valve open/close limit switches by operating the valve, not by installing a jumper on the limit switch contacts. However, if the equipment or process is not available to test a signal over its entire calibrated range, the PCSS may test using a simulation methods and make a note on the sign-off form.
3. The following I/O tests shall be performed:

- a. Discrete Input – At the device or instrument, change signal condition from the inactive to active state. Observe results on all indicators within the loop such as the HMI screens, the OIT screens, pilot lights, horns, beacons etc.
 - b. Analog Input – Test the analog signal over the entire engineering range at various intervals including 0, 50%, and 100% as well as on increasing and decreasing range. Observe results on all indicators within the loop such as the HMI screens, the OIT screens, recorders, digital indicators, etc.
 - c. Discrete output signals shall be tested by switching the equipment to manual control at the HMI and OIT nodes and turning the output on or using other means to turn the output on. Then verify the equipment responds accordingly.
 - d. Analog output signals shall be tested by switching the equipment to manual control at the HMI and OIT nodes and turning the output on or other means to turn the output on. Then verify the equipment responds accordingly.
- I. Testing of Automatic Control Strategies
 - 1. All automatic control strategies shall be verified using actual process equipment and instruments, or other means, to verify the logic performs as expected. Verify faults and logical failure scenarios for control strategies such as instrument failures, equipment failures, loss of communication between the HMI Server and the PLC, loss of peer-to-peer communication, out of range testing for analog inputs, loss of power, and all other strategies specified in the control strategy document.
- J. Upon successful completion of the ORT, the PCSS shall submit a record copy of the test results as specified in Part 1 and request the scheduling of the FDT.

3.5 FIELD TESTING - FUNCTIONAL DEMONSTRATION TEST (FDT)

- A. After the facility is started-up and running the treatment process in automatic control to the extent possible, a Functional Demonstration Test shall be performed. The purpose of the FDT is to allow the Engineer and/or Owner representatives to witness the actual functionality, performance, and stability of the system while connected to the process equipment.
- B. Required Documents for Test
 - 1. Set of panel drawings and wiring diagrams from ORT with corrections noted
 - 2. Set of contract documents - all drawings and specifications.
 - 3. All design change related documentation.
 - 4. Signed-off master copy of the PCSS developed field testing signoff forms.
 - 5. Testing procedures.
 - 6. Copy of completed calibration forms.
 - 7. One copy of all O & M Manuals for PCSS supplied equipment.
- C. A witnessed FDT shall be performed on each process area. To the extent possible, repeat the testing performed during the ORT.
- D. The daily schedule specified to be followed during the factory tests shall also be followed during the FDT.

- E. After coordinating with Operations, a "Black Start" of the plant shall be performed to confirm the plant operation recovers as specified in the contract documents. Black start means shutting off power to the plant and turning it back on. Separate tests shall be performed by recovering the plant while on generator (if a generator is specified) and while on utility power.
- F. Punchlist items and resolutions noted during the test shall be documented on the Punchlist/Resolution form. In the event of rejection of any part or function test procedure, the PCSS shall perform repairs, replacement, and/or retest within 10 days.
- G. Upon successful completion of the FDT, the PCSS shall submit a record copy of the test results as specified in "Part 1-General".

3.6 FIELD TESTING - SITE ACCEPTANCE TEST (SAT)

- A. After completion of the FDT, and the system is started-up and running the process in automatic control to the extent possible, the system shall undergo a test as defined in the Division 1 "Equipment Testing and Start-up" section.
- B. While this test is proceeding, the Engineer and Owner shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes. Plant operations shall remain the responsibility of Owner and the decision of plant operators regarding plant operations shall be final.
- C. During this test, PCSS personnel shall be present as required to address any potential issues that would impact system operation. The PCSS is expected to provide personnel for this test who have an intimate knowledge of the hardware and software of the system. When PCSS personnel are not on-site, the PCSS shall provide cell phone/pager numbers that Owner personnel can use to ensure that support staff are available by phone and/or on-site within four hours of a request by operations staff.
- D. Any malfunction during the test shall be analyzed and corrections made by the PCSS. In the event of rejection of any part or function, the PCSS shall perform repairs or replacement within 5 days.
- E. Throughout the duration of the SAT, no software or hardware modifications shall be made to the system without prior approval from the Owner or Engineer.

3.7 CERTIFICATE OF INSTALLATION

- A. Following successful completion of the SAT test, the PCSS shall submit a Certification of Installation for the system as required in the Division 1 "Equipment Testing and Start-up" section.

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APPENDIX 13302-A: EXAMPLE INPUT/OUTPUT (I/O) STATUS SIGN OFF FORM

An example template for the I/O Status signoff form to be used for documenting testing results to the owner is attached. The PCSS is required, prior to testing, to create a project specific I/O Status signoff form based on the attached template or approved equal. The PCSS may obtain an electronic copy of the template from the Engineer or develop it on their own.

APPENDIX 13302-B: EXAMPLE AUTOMATIC CONTROL STRATEGIES SIGN OFF FORM

An example template for the Automatic Control Strategies signoff form to be used for documenting testing results to the owner is attached. The PCSS is required, prior to testing, to create a project specific Automatic Control Strategies signoff form based on the attached template or approved equal. The PCSS may obtain an electronic copy of the template from the Engineer or develop it on their own.

[Project Name] Appendix A - Input/Output (I/O) Status Sign-Off Form										All Sections below are required to be filled out by PCSS as part of Field Testing.			
8-Sep-11										Instrument Alarm Setpoint - Setpoint for any alarms set by PCSS			
										Wiring Complete - Signal wired from field device to PLC			
										I/O Tested - Signal tested from field device to SCADA HMI			
PLC	Signal Tag	Description	Range or Active State when closed	P&ID	Signal	Rack	Slot	Channel	Instru-ment Alarm Setpoint	Calibrate, config., and Wiring complete	Date	I/O Tested	Notes
PLC-SC	LT-4000-1	Secondary Clarifier No. 1 Sludge Level	0-10 ft	8	AI	2	1	0					
PLC-SC	LT-4010-3	Secondary Clarifier No. 3 Sludge Level	0-10 ft	8	AI	2	1	1					
PLC-SC	SI-4100-1	RAS Pump No. 1 Speed Feedback	0-100%	14	AI	2	1	2					
PLC-SC	SI-4100-4	RAS Pump No. 4 Speed Feedback	0-100%	15	AI	2	1	3					
PLC-SC	FI-4102-1	RAS Flow Pumps 1-3	0-1900 GPM	14	AI	2	1	4					
PLC-SC	SI-4110-1	WAS Pump No. 1 Speed Feedback	0-100%	14	AI	2	1	5					
PLC-SC	N/A	Spare Slot	N/A	N/A	Spare	2	5	N/A					
PLC-SC	SC-4100-1	RAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7	0					
PLC-SC	SC-4100-2	RAS Pump No. 2 Speed Setpoint	0-100%	14	AO	2	7	1					
PLC-SC	SC-4100-3	RAS Pump No. 3 Speed Setpoint	0-100%	14	AO	2	7	2					
PLC-SC	SC-4110-1	WAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7	3					
PLC-SC	Spare	Spare	N/A	N/A	AO	2	7	4					
PLC-SC	Spare	Spare	N/A	N/A	AO	2	7	5					
PLC-SC	TSH-4000-1	Secondary Clarifier No. 1 High Temp	Normal	8	DI	3	1	0					
PLC-SC	XA-4000-1	Secondary Clarifier No. 1 Motor Overload	Normal	8	DI	3	1	1					
PLC-SC	WAH-4000-1	Secondary Clarifier No. 1 High Torque	Normal	8	DI	3	1	2					
PLC-SC	WAH-4000-1	Secondary Clarifier No. 1 High Torque	Normal	8	DI	3	1	3					
PLC-SC	YRI-4000-1	Secondary Clarifier No. 1 On/Off	On	8	DI	3	1	4					
PLC-SC	YRI-4000-1	Secondary Clarifier No. 1 In Remote	In Remote	8	DI	3	1	5					
PLC-SC	YFI-4100-1	RAS Pump No. 1 VFD Fault	Normal	14	DI	3	1	6					
PLC-SC	FAL-4100-1	RAS Pump No. 1 Low Flow	Normal	14	DI	3	1	7	50 GPM	RJM	12/18/2011	JAS	12/22/2011
PLC-SC	Spare	Spare	Normal	14	DI	3	1	8					Example completed line
PLC-SC	YRI-4100-1	RAS Pump No. 1 Running	Running	14	DI	3	1	9					
PLC-SC	YFI-4100-1	RAS Pump No. 1 In Remote	In Remote	14	DI	3	1	10					
PLC-SC	YFI-4110-1	WAS Pump No. 1 VFD Fault	Normal	14	DI	3	1	11					
PLC-SC	FAL-4110-1	WAS Pump No. 1 Low Flow	Normal	14	DI	3	1	12					
PLC-SC	Spare	Spare	Normal	14	DI	3	1	13					
PLC-SC	YRI-4110-1	WAS Pump No. 1 Running	Running	14	DI	3	1	14					
PLC-SC	YFI-4110-1	WAS Pump No. 1 In Remote	In Remote	14	DI	3	1	15					
PLC-SC	HSS-4000-2	Secondary Clarifier No. 2 Start Command	Start	8	DO	4	6	0					
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	1					
PLC-SC	HSS-4100-2	RAS Pump No. 2 Start Command	Start	14	DO	4	6	2					
PLC-SC	HSS-7000-2	Sludge Holding Tank Tank Blower No. 2 Start Command	Start	17	DO	4	6	3					
PLC-SC	HSS-4100-5	RAS Pump No. 5 Start Command	Start	15	DO	4	6	4					
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	5					
PLC-SC	HSS-4105-1	Secondary Scum Pump No. 2 Start/Stop	Start	15	DO	4	6	6					
PLC-SC	HSS-4110-2	WAS Pump No. 2 Start/Stop Command	Start	15	DO	4	6	7					
PLC-SC	7160-FQ1	Sludge Loadout LCP Pumping Indicator	Pumping	17	DO	4	6	8					
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	9					
PLC-SC	HSS-7115-2	Sludge Holding Tank Mixer No. 2 Start	Start	17	DO	4	6	10					
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	11					
PLC-SC	HSS-7117-2	Sludge Holding Tank Discharge Valve No. 2 Open CMD	Open	17	DO	4	6	12					
PLC-SC	HSC-7117-2	Sludge Holding Tank Discharge Valve No. 2 Close CMD	Close	17	DO	4	6	13					
PLC-SC	HSS-7120-2	TS Transfer Pump No. 2 Start Command	Start	17	DO	4	6	14					
PLC-SC	Spare	Spare	N/A	N/A	DO	4	6	15					
										Page 1 of 1			

7-Oct-11	[Project Name] Appendix B - Automatic Control Strategies Sign-Off Form				
	All Sections below are required to be filled out by PCSS as part of Testing.				
	Auto. Control Strategies. - Loop operational in Automatic as defined in Control Strategies				
Control Strategies Loop #	Control Strategy Description	P&ID	Auto. Control Strategy	Date	Notes
LOOP 281 - 284	LOW FLOW PUMPS	8			
LOOP 290	LOW EQ CHANNEL FLOW NO.4	8			
LOOP 300	MICROFILTRATION AIR SUPPLY LOW PRESSURE	10			
LOOP 351, 352	SITE LIFT STATION PUMP NO.1 AND NO. 2	12			
LOOP 355	SITE LIFT STATION HIGH AND LOW LEVEL CONTROL	12			
LOOP 371, 372	SLUDGE HOLDING TANK NO.1 AND NO. 2 LEVEL	14			
LOOP 381, 382	SLUDGE TRANSFER PUMPS	14			
LOOP 385	SLUDGE TRANSFER PUMPS REMOTE START/STOP COMMAND	14			
LOOP 700	EFFLUENT PUMPING STATION LEVEL	14			
LOOP 701, 702, 703	EFFLUENT PUMP NO.1	14			
LOOP 840	POST AERATION CHANNEL AIR FLOW CONTROL	15			
LOOP 900	SLUDGE TRANSFER PUMPS DISCHARGE FLOW	8			
LOOP 971	CENTRIFUGE SLUDGE FEED PUMP NO.1	8			
LOOP 1001	CENTRIFUGE NO.1 SLUDGE FEED FLOW CONTROL	8			
LOOP 1411, 1412	SODIUM HYPOCHLORITE STORAGE TANKS LEVEL	8			
LOOP 1421, 1422	SODIUM HYPOCHLORITE PUMPS	8			
LOOP 1430	SODIUM HYPOCHLORITE STORAGE TANKS				
LOOP 2051, 2052, 2053	CONTAINMENT AREA HIGH LEVEL DETECTION	14			
LOOP 2055	DIESEL ENGINE GENERATOR STATUS	14			
LOOP 2060	TRANSFER SWITCH STATUS	14			
APPENDIX ONE	GENERATOR KILOWATTS MONITORING	14			
	EQUIPMENT RESTART DURING A POWER LOSS WITH THE GENERATOR RUNNING	14			
APPENDIX TWO	EQUIPMENT RESTART WITH POWER RESTORED AFTER A POWER LOSS	14			
N/A	SELF-HEALING CAPABILITIES OF NETWORK	N/A			
N/A	REDUNDANT SCADA SERVER FAILOVER AND RECOVERY	N/A			
Page 1 of 1					

END OF SECTION 13302

SECTION 13303

INSTRUMENTATION AND CONTROLS – TRAINING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish training as specified herein.
- B. This section covers the training requirements for all devices and systems furnished and installed as detailed on the Drawings.
- C. Refer to Section 13300.

1.2 RELATED WORK

- A. Refer to Section 13300.

1.3 SUBMITTALS

- A. Refer to Section 13300 for general submittal requirements.
- B. Preliminary Training Plan Submittal
 - 1. Prior to the preparation of the Final Training Plans, submit outlines of each training course including course objectives and target audience, resumes of instructors, prerequisite requirements for each class, and samples of handouts for review.
- C. Final Training Plan Submittal
 - 1. Upon receipt of the Engineer's comments on the preliminary training plan, submit the specific proposed training plan. The training plan shall include:
 - a. Definitions, objectives, and target audience of each course.
 - b. Schedule of training courses including proposed dates, duration and locations of each class.
 - c. Complete copy of all proposed handouts and training materials. Training information shall be bound and logically arranged with all materials reduced to a maximum size of 11 inch by 17 inch, then folded to 8.5 inch by 11 inch for inclusion into the binder.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. The cost of the training programs shall be included in the Contract price. The training and instruction shall be directly related to the system being supplied. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the system.
- B. All training schedules shall be coordinated with and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER'S working schedule.
- C. All onsite instructors must be intimately familiar with the operation and control of the OWNER'S facilities.
- D. Provide detailed training manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project. The manuals shall be provided in hardcopy for each student. Provide electronic copy of each training manual in PDF format for OWNER'S future use.
- E. The trainer shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, all training materials shall be delivered to OWNER.
- F. The OWNER reserves the right to videotape all custom training sessions. All training tapes shall become the sole property of the OWNER.

3.2 TRAINING SUMMARY

- A. The following training courses listed in the summary table shall, as a minimum, be provided:

Description	Minimum Course Duration (hours)	Maximum Number of Trainees per Course	Number of Times Course to be Given	Intended Audience
Onsite Training				
Control System Overview Seminar	Covered in AESS scope of work			
Operator Control System Training	Covered in AESS scope of work			
System Reports and Historian Implementation	Covered in AESS scope of work			
Installed Control System	2	2	1	Maintenance, Administrator
Instrument manufacturer training - analyzers <i>(add a row for each specific instrument requiring manufacturer's training)</i>	4	2	1	Maintenance
Instruments	4	2	1	Maintenance
Instruments - Operator familiarity	2	2	1	Operations

B. Definitions of audience roles

1. Administrator - personnel responsible for maintaining the HMI / SCADA system.
2. Maintenance - personnel responsible for maintaining the field controller hardware and instrumentation system.
3. Operations - personnel responsible for daily plant operations.
4. Management - non-daily operations personnel

3.3 ONSITE TRAINING

A. Training personnel shall be intimately familiar with the control system equipment, its manipulation, and configuration. Training personnel shall command knowledge of system debugging, program modification, troubleshooting, maintenance procedure, system operation, and programming, and shall be capable of transferring this knowledge in an orderly fashion to technically oriented personnel.

B. Installed Control System Training

1. Provide training for the OWNER'S personnel in the functionality, maintenance, and troubleshooting, of the installed Control System. The training shall be held before the Functional Demonstrator Test (FDT), but not more than two months before.
2. Training and instruction shall be specific to the system that is being supplied.
3. Training shall consist of classroom instructions and hands-on instruction utilizing the OWNER'S system.
4. Detailed training shall be provided on the actual configuration and implementation for this Contract. Training shall cover all aspects of the system that will allow the OWNER'S personnel to maintain, modify, troubleshoot, and develop future additions/deletions to the system. The training shall cover the following subjects, as a minimum:

- a. System overview.
 - b. System hardware components and specific equipment arrangements.
 - c. Periodic maintenance.
 - d. Troubleshooting and diagnosis.
 - e. Network configuration, communications, and operation.
 - f. TCP/IP addressing procedures for all Ethernet devices.
- C. Instrument Manufacturer Training
 - 1. Manufacturer instrument training shall be provided for those instruments where specifically indicated in the Instruments section. This shall be on-site training provided by an authorized representative of the manufacturer. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.
- D. Instrument Training
 - 1. Provide instruction on the maintenance of the field and panel instrumentation for the OWNER'S instrumentation technicians. This training shall be conducted before the FDT, but no more than 1 month before and at a time suitable to the OWNER. This training shall take place at the OWNER'S facility. As a minimum the following shall be included:
 - a. Training in standard hardware maintenance for the instruments provided.
 - b. Specific training for the actual instrumentation configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up for this Contract.
 - c. Test, adjustment, and calibration procedures.
 - d. Troubleshooting and diagnosis.
 - e. Periodic maintenance.
- E. Instruments - Operator familiarity
 - 1. Provide operator level instruction on the use of the field and panel instrumentation for the OWNER'S operations staff. This training shall be conducted before the 30 day site acceptance test, but no more than 1 month before and at a time suitable to the OWNER. This training shall take place at the OWNER'S facility. Include hands on demonstration of the information each transmitter indicates and the method used to retrieve any operator information from the transmitter, including use of pushbuttons and interpretation of international graphic symbols used on the instruments.

END OF SECTION 13303

SECTION 13305

I&C - CONTROL DESCRIPTIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section is provided to clarify the control strategies to be used to program the system.
- B. All SCADA PLC controller programming and SCADA Operator Interface Terminal (OIT) or Operator Workstation Station (OWS) graphics and programming shall be performed as defined in Section 13300.

1.2 RELATED WORK

- A. Refer to Section 13300.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. The control descriptions are broken into areas.
 - 1. Ground Water Pumps
 - 2. Ground Water Flow
 - 3. GST Tank Level
 - 4. Booster Pump System
 - 5. Booster Pump System Pressure
 - 6. Booster Pump System Flow
 - 7. Chlorine Analyzer
 - 8. Chemical Feed System

3.2 CONTROL FUNCTION DEFINITIONS AND GENERAL CRITERIA

- A. The hardware and/or software functions noted by this paragraph reference are to be implemented by the SCADA PLC/OWS control system specified herein.

- B. The control functionality of this new equipment/system shall follow the control functionality of the existing equipment/system already on-site.
- C. Programming standards and formats used for this new equipment/system shall follow the programming standards and formats of the existing equipment/system already on-site.
- D. The following list of ISA abbreviations is typical of those utilized. The description, following the abbreviation, summarize the basic function to be implemented in the SCADA PLC/OWS software.
 - 1. HS: Represent selector switches or pushbuttons, which shall be implemented by keyboard entry. Function shall be similar to their hardware counterparts. Examples are as follows:
 - a. HSH- Open Command
 - b. HSL- Close Command
 - c. HSS-Start/Stop Command
 - 2. YI: Represents equipment status (i.e., availability, running, in remote, etc.) implemented by a change of color on the OWS symbol for this equipment. For motor driven equipment such as pumps, blowers, compressors, etc., availability contact represents remote operation and no alarm conditions. Examples are as follows:
 - a. YCI-Selector switch in computer, auto or remote position
 - b. YRI-Motor running status
 - c. YFI- Motor failure or overload status
 - d. YMI- Selector switch in maintenance position
 - 3. PAL, AAH, UA, etc.: Represent high or low alarms implemented on the OWS.
 - 4. FIC, PIC, AIC, etc.: Represent PID process controllers implemented in a computer logic algorithm incorporating proportional, integral, and/or derivative modes. Local/remote and manual/auto capabilities shall be provided.
 - 5. FIK, PIK, AIK, etc.: Represent control stations implemented in logic (via keyboard entry and CRT display) to allow downloading of a set point to a FIC, PIC, AIC, etc., and display of the process variable or controller output.
 - 6. FI, PI, AI, etc.: Represent digital output display on the CRT of a process variable in engineering units and/or a dynamic representation of the variable by symbol or graphical means.
 - 7. FIR, PIR, AIR: Represent values stored on the hard disk to provide the data for historical trend graphics of process variables against time (or other selected variables).
 - 8. ZSH, ZSL etc.: Represent high or low, open or close limit positions implemented on the OWS
- E. Any interlocks that are represented, before the local operational descriptions, or are stated as hardwired interlocks, shall interlock all the controls locally and at the SCADA PLC/OWS or at the vendor PLCs. The SCADA PLC shall be programmed to shut down that equipment if that hardwired interlock is also wired to the SCADA PLC.

- F. Any interlocks that are represented in a particular layer of the operational descriptions, shall interlock all the controls in that layer and the layer after it. However, the interlock shall not interlock the commands in the layer before it.
- G. The SCADA system shall stop a motor or drive in its program if it does not receive the auto or remote status or one of its software interlocks trip. If the drive or motor is in hand or remote it will continue to run but the SCADA start/stop output will be open.
- H. Any motor that is requested to start by an operator or an automatic program shall alarm if the run confirm status for that motor does not activate within two seconds. If a motor stops by an interlock or stops without any operator or SCADA intervention, then that motor shall go into alarm. Any motors that are stopped by a program or the operator shall not go into an alarm.
- I. Any valve that is requested to open by an operator or an automatic program shall alarm if the open feedback status for that valve does not activate within ten seconds. Any valve that is requested to close by an operator or an automatic program shall alarm if the close feedback status for that valve does not activate within ten seconds.
- J. Motors that have an H/O/A shall indicate to the operator that the pump is being run in the "Hand" position. A motor is being run in "Hand" when the "Auto" position is not true and the run confirm status is true. If not in "Auto" the SCADA PLC shall open up its output contact to stop (shutdown) the pump from SCADA.
- K. Terminology associated with interlocks is as follows:
 - 1. When a contact or status is true, the SCADA computer will receive power to its input channel. The SCADA computer registers this as a binary bit of one.
 - 2. When a contact or status is false, the SCADA computer will receive no power (open circuit) to its input channel. The SCADA computer registers this as a binary bit of zero.
- L. When an analog signal goes outside the 4-20 mA range due to a failure at the instrument or PLC card, the following SCADA programming shall take place:
 - 1. Alarm the signal at any local OITs and in the HMI system.
 - 2. If the analog signal is associated with a control loop or ratio control loop that loop shall go into manual.
 - 3. If the analog signal is used in a calculation, that calculation shall use the last good analog signal. The computer shall place the control loop in manual if using the calculation.
- M. Disable all alarms on analog inputs unless specifically called for in the drawings or specifications.
- N. All interlocks that shutdown (Stop a piece of equipment and prevent it from being restarted or moved) shall be shown on the faceplate pop-up graphic for that piece of equipment.

- O. The run confirms or on status of all motors and lamps shall be accumulated to calculate a run time status of the equipment on the HMI graphic. Each run time accumulation shall come with a reset button on the HMI screen.
- P. All flow indications shall be totalized. Do not totalize if the analog signal is outside the 4-20 mA range. Each flow totalization shall come with a reset button on the HMI screen. Do not totalize if the value of the flow input is less than 2% of the full range of the input.

3.3 INDIVIDUAL CONTROL DESCRIPTIONS AND CONTROL SEQUENCES

A. Ground Water Pump

- 1. General:
 - a. On/off operation of the pump. The Operation of the pump is either at pump's reduced voltage soft start (RVSS) controller panel or at the SCADA PLC/OWS.
- 2. Control:
 - a. With the local HOR selector switch in the "Hand" position the pump shall start. With the local HOR selector switch in the "Off" position the pump shall stop. With the local HOR selector switch in the "Remote" position the pump shall be control via the SCADA system.
 - b. From the SCADA PLC/OWS graphic screen the operator may place the pump in manual and start or stop the pump.
 - c. From the SCADA PLC/OWS graphic screen the operator may place the pump in the "Automatic" mode and the pump shall start and stop based on a combination of the ground storage tank level and the status of the peak timer.
 - d. From the SCADA PLC/OWS graphic screen the operator shall be able to adjust the Pump On Level and Pump Off Level.
 - e. A check valve fault shall be determined when the pump is running and the check valve status is not true after a pre-determined amount of time. The check valve fault shall clear once the alarm condition is cleared and the operator resets the fault.
- 3. Alarms / Monitoring:
 - a. Pump On/Off
 - b. Pump Remote/NIR
 - c. Pump Overload/Fail
 - d. Pump Fail to Start
 - e. Pump Check Valve Fault

B. Ground Water Flow

- 1. General:
 - a. Display the ground water flow on the SCADA PLC/OWS. This flow shall also be used to flow pace the chlorine feed system.
- 2. Control:
 - a. A daily flow total alarm shall be generated when the daily flow total is greater than or equal to the operator adjustable well daily flow limit. This alarm shall not stop the system operating but shall alarm on the graphic screen and alarm

summary. This alarm shall be reset with the daily flow total is reset to 0 at midnight.

3. Alarms / Monitoring:
 - a. Ground Water Flow.
 - b. Daily Flow Total Alarm.

C. Elevated Storage Tank Level

1. General:
 - a. Display the elevated storage tank level on the SCADA PLC/OWS. This level shall also be used to start and stop the ground water pump
2. Control:
 - a. NA
3. Alarm / Monitoring:
 - a. Elevated Storage Tank Level

D. Booster Pump System

1. General:
 - a. On/off operation of the pump. The Operation of the pump is either at pump's controller panel or at the SCADA PLC/OWS.
2. Control:
 - a. With the local HOR selector switch in the "Hand" position the pump shall start. With the local HOR selector switch in the "Off" position the pump shall stop. With the local HOR selector switch in the "Remote" position the pump shall be control via the SCADA system.
 - b. From the SCADA PLC/OWS graphic screen the operator may place the pump in manual and start or stop the pump.
 - c. From the SCADA PLC/OWS graphic screen the operator may place the pump in the "Automatic" mode and the pump shall start and stop based on the booster pump system pressure.
 - d. The pump rotation logic shall alternate between the two proposed booster pumps.
3. Alarms / Monitoring:
 - a. Pump On/Off
 - b. Pump Remote/NIR
 - c. Pump Overload/Fail
 - d. Pump Over Temperature
 - e. Pump Fail to Start

E. Booster Pump System Pressure

1. General:
 - a. Display the booster pump system pressure on the SCADA PLC/OWS. This pressure shall also be used to control the speed of the booster pump system.
2. Control:
 - a. NA
3. Alarms / Monitoring:
 - a. Booster Pump System Pressure

F. Booster Pump System Flow

1. General:
 - a. Display the booster pump system flow on the SCADA PLC/OWS.
2. Control:
 - a. NA.
3. Alarms / Monitoring:
 - a. Ground Water Flow.
 - b. Daily Flow Total Alarm.

G. Chlorine Residual

1. General:
 - a. Display the status of the chlorine residual analyzer. This chlorine residual analyzer shall also be used to pace the chlorine feed system.
2. Control:
 - a. None
3. Alarms / Monitoring:
 - a. Chlorine Level
 - b. Chlorine High
 - c. Chlorine Low

H. Chlorine Feed System

1. General:
 - a. Start/stop the chlorine feed system and pace the pumps with their appropriate process control variable.
2. Control:
 - a. The chlorine feed pump for the ground water system shall be paced with the ground water flow meter. If the ground water pump is running then the chlorine feed system shall start and shall flow pace with the ground water flow meter. When the ground water pump shuts down the chlorine feed pump shall also shut down.
 - b. From the SCADA PLC/OWS the operator shall be able to adjust all of the control parameters associated with the chlorine feed system.
3. Alarms / Monitoring:
 - a. Chlorine Feed Pump On/Off
 - b. Chlorine Feed Pump Fault

END OF SECTION 13305

SECTION 13306

I&C – APPLICATIONS ENGINEERING SERVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Refer to section 13300.
- B. If referred to anywhere else in the project manual, Application Engineering (AE) or Applications Engineering System Supplier (AESS) services are those services specified in this section.
- C. Provide all programming, configuration, and related services required to achieve a fully integrated and operational system as specified herein. All equipment shall be controlled in full conformity with the contract drawings, process control descriptions, specifications, engineering data, instructions, and recommendations of the equipment manufacturer. Coordinate the control system for proper operation with related equipment and materials furnished by other suppliers under other Sections of these specifications and with related existing equipment.
 - 1. Provide configuration of the PLC provided for all equipment shown on the drawings, except for controls equipment shown being provided as part of a vendor package system.
 - 2. Provide configuration of the HMI System Software, Operator Interface Terminals, and drivers provided for all equipment shown on the drawings, including equipment provided by vendor package systems.
 - 3. Provide for and test communications and functionality between all connected devices (such as PLCs) and the HMI software packages, including devices supplied by others, as depicted on the system architecture drawings in order to provide a comprehensive working system of data collection, storage and reporting.
 - 4. All work shall be coordinated with plant operating personnel to minimize impacts on daily operation. Delays caused for any reason shall be noted and formally submitted to the Engineer and the Owner in the form of a letter.

1.2 RELATED WORK

- A. Refer to Section 13300.

1.3 SUBMITTALS

- A. Provide all required submittals in accordance with Section 01300, Submittals. The submittals listed below shall be provided as a minimum.

1. System Standards and Conventions
 2. Operator Interface
 3. Controller Program
 4. Operations and Maintenance Manuals
- B. Supplement to Project Plan Submittal
1. Supplement the "Project Plan, Deviation List, and Schedule" submittal in section 13300 by adding the following items to the submittal requirements:
 - a. List of all graphics intended to be created for this project.
 - b. List of all PLC programs that will be created or modified for this project.
- C. Supplement to Input/Output (I/O) List Submittal
1. Supplement the "Input/Output (I/O) List " submittal in section 13300 by adding the following item to the submittal requirements:
 - a. LOGICAL POINT ADDRESS: I/O address of each point.
- D. System Standards and Conventions Submittal
1. Following the standards and conventions workshop, submit the standards and conventions that will be used on this project. The submittal shall define, at a minimum:
 - a. Graphic display standards, including color conventions, equipment symbols, display format, equipment control pop-up displays, trend displays, and display navigation. Include samples of each proposed type of graphic display (i.e., overview, detail, diagnostic, tabular, etc.)
 - b. System naming conventions, such as graphic displays naming, database naming, tag names, and computer naming.
 - c. System configuration, including network addressing and PLC/RTU addressing
 - d. Alarm configuration standards, including priorities and logging
 - e. Security configuration standards, including user groups and privileges
 - f. PLC/RTU standard programming modules, including analog input scaling, flow totalization, equipment runtime, motor start/stop, valve open/close, and any other standard logic planned to be used.
 2. To facilitate the Owner's future operation and maintenance, the submitted standards and conventions shall be used as the basis for programming and configuration of the system. System programming and configuration shall not begin prior to the System Standards and Conventions Submittal.
- E. Operator Interface
1. Following the approval of the standards and conventions submittal, submit a draft of all proposed graphic displays, examples of each type of pop-up (faceplate) displays, and examples of trends. For those graphics which will be duplicated more than once for similar type of equipment, submit the graphics for the first equipment only.
 2. Following the draft graphics review meeting and prior to the factory test, submit a ready-for testing version of all graphic displays. These graphics should be

completely finished other than the incorporation of comments and changes resulting from testing.

3. Submitted graphic displays and trends shall be no less than 8.5 inches by 11 inches and in full color.

F. Controller Program Submittal

1. For each controller, submit the following using the controller manufacturer's built in printing functions. Electronic submission of Adobe Portable Document Format ("pdf") files in lieu of paper submittals is acceptable. Review will be for general program organization, level of documentation, and overall programming standards (basic pump and valve control, for example). The review will not attempt to confirm the logic works correctly for every loop.
 - a. PLC programs showing ladder logic, function block, high level language or other controller language used. Include individual rung, network, and/or command descriptions with abundant comments to clearly identify function and intent of each code segment. Each logic segment shall be clearly presented, the function of each timer described, the purpose of each subroutine call labeled and defined, etc. Program documentation shall be sufficiently clear to allow determination of compliance with the process control requirements included in the control descriptions and with the Drawings. The submittal shall demonstrate that all logic provided under this project follows the same structure and format and reflects a common programming approach.
 - b. Submit a memory usage report for the controller. This report shall indicate total memory capacity and unused memory capacity.
 - c. Submit cross reference index of I/O allocation and controller memory address. Every physical I/O point as well calculated or virtual I/O required for the implementation of the process scheme shall be included.
2. Submit details of control system communication. Submit a "memory map" or other means showing which signals are exchanged between PLCs. Also submit a HMI tag database showing all signals exchanged between the PLCs and HMI. Any specific communication block memory addresses shall be defined.

G. O&M Manuals - Software Maintenance Manuals

1. Include these manuals as part of 13300 "Final System Documentation". This required information is in addition to any requirements of Section 13300.
2. Software Listings and Databases- Submit hard copies of the same information required in the "Controller Program Submittal" except include files updated to reflect the as built system. Include PDF versions of these files in the CD specified below.
3. PID Loop Tuning Parameters - Submit annotated chart recorder traces or computer system trend screen printouts showing tuned control loop response to plus and minus 40 percent of full span step changes of loop setpoint for each individual loop. For cascade loops, submit charts showing response of the secondary loop with secondary setpoint on manual and also response of the entire cascade control loop in automatic mode. Include a description of tuning methodology used.

4. If available as part of the software provided, supply hardcopies of configuration information for the HMI systems, reporting systems, Historian Systems, and any other programs developed under this Contract.
5. Machine Readable Documentation - Provide two sets of as built software documentation on CD-ROMs in original electronic format for all PLC, HMI systems, reporting systems, Historian Systems, and any other programs developed under this Contract. Any changes made during or after testing, start-up, and commissioning shall be incorporated.

H. O&M Manuals - Operator Manuals

1. Provide Operator's Manuals prior to final acceptance of the system.
2. These manuals shall be separately bound and shall contain all information necessary for the operator to monitor and control the plant from the control system. The manuals shall be written in non-technical terms and shall be organized for quick access to each detailed description of the operator's procedure. Manuals shall contain, but not be limited to, the following information:
 - a. A comprehensive table of contents of the manual.
 - b. A simple overview of the entire system indicating the function and purpose of each piece of equipment.
 - c. A detailed description of the operation of the HMI and OIT including all appropriate displays. Including a screenshot of each HMI and OIT display screen and annotating each function in text is an acceptable format for presenting this information.
 - d. Step-by-step procedures for starting up or shutting down an individual component of the control system and also of the entire system.
 - e. Login / logout procedures.
 - f. Complete, step-by-step procedures for printing reports and entering manual data.
 - g. Complete, step-by-step procedures for performing system or selected file backup and restoration including archiving historical data. Include recommended archiving schedule for historical data.
 - h. Operational description for operating HMI computer equipment and peripherals including printers, CD-ROMs, removable bulk storage devices, UPS, etc. Description shall include procedures for typical maintenance and troubleshooting tasks.
 - i. A complete glossary of terms and definition of acronyms.
 - j. List of personnel to be contacted for warranty and emergency services, including name, address, telephone number, pager or cell phone number, fax number, and email address
3. Include these manuals as part of 13300 "Final System Documentation". This required information is in addition to any requirements of Section 13300.

1.4 MAINTENANCE

- A. Refer to section 13300.

1.5 WARRANTY

- A. Refer to Section 13300 and supplement that with the requirements below.
- B. All application work shall be warranted in accordance with Section 01740
- C. Provide telephone technical support within 4 hours of warranty claim. If failure cannot be resolved by telephone, provide onsite technical support within 24 hours of warranty claim.

1.6 COORDINATION MEETINGS AND WORKSHOPS

- A. Refer to Section 13300. The meetings below are in addition to the meetings specified in that section.
- B. Schedule and conduct a standards and conventions workshop. The purpose of this workshop shall be to review the standards, conventions, and methodologies that will be used to program and develop the programs (i.e., HMI and PLC databases, HMI graphics, and PLC programming, etc.) and will solicit Engineer and Owner's input. Submit an agenda with examples for items to be discussed at a client workshop.
- C. Schedule and conduct a draft graphics review meeting. The purpose of this meeting shall be to present draft graphics for the Owner's and Engineer's review and feedback prior to creating the full set of graphics for review. For repetitive graphics such as graphics for multiple process trains, include an example of the first graphic only for discussion. Include discussion of process and overview displays, examples of pop-ups, trends, and system navigation tools. Expect major comments and incorporate any changes resulting from those comments.
- D. Schedule and conduct a field-testing coordination meeting two weeks prior to field testing. The purpose of this meeting is to discuss the specifics of the proposed tests and to provide a forum for coordinating the required field-testing.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. The system specified herein shall perform the following generalized functions:
 - 1. The system shall allow the operator to control equipment such as pumps and valves as shown on the Drawings and as defined in Section 13305 control descriptions.

2. Perform real-time process control, including proportional integral derivative control action, sequencing, process calculations, etc.
3. Collect, calculate, and store accurate, reliable operating information for present and future uses.
4. Assist remote site operating personnel by noting and communicating off normal operating conditions and equipment failures.
5. Accumulate and store equipment running times for use in preventative maintenance.
6. Provide color graphic displays and reports for use by the system operating and supervisory personnel.
7. Provide trending for all analog values.
8. Provide control system diagnostics.
9. All process control functions including PID, calculations, sequencing, timing, etc., shall be done in the process controller. The HMI software shall perform the real-time database, report generation, graphic screens, program development, set point modification, data archiving, etc.
10. The system shall allow the operator to manually control (by keyboard entry and mouse type pointing device) the status of pumps, valves, etc. (i.e., on off, open close, setpoint value, etc.) when viewing the appropriate graphic screen on the HMI.

3.2 CONTROLLER PROGRAMS

- A. All applications programs shall be developed in a structured manner and shall follow an intuitive arrangement so that an instrumentation technician with basic programming knowledge will be able to understand. Programs shall utilize standard program templates or subroutines for repetitive logic such as equipment control, flow total calculations, equipment runtime calculations.
- B. Make changes to the application programs and software configuration, based on comments during the submittals, the factory tests, the field tests, and during the commissioning process to meet the design intent, at no additional cost to the Owner.

3.3 GRAPHIC DISPLAYS - GENERAL

- A. All displays shall contain and continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers. All process variables shall be displayed on their associated display(s) with correct engineering units. Process variables shall display their associated data quality flags.
- B. All operator commands related to controlling field devices or system attributes shall require multiple keystrokes or mouse actions to protect against inadvertent operations. The operator shall receive confirmation of the selected point to be controlled, at which time a cancellation of the control can be affected.

- C. Process graphic displays, shall be based on the P&ID's, site plan drawings, mechanical drawings and electrical drawings included in these Contract Documents. The graphic displays shall depict process flow streams, process structures, and all major items of process equipment and control devices in a schematic format.
- D. All main graphical screens shall include a title bar, main graphic area, navigational buttons, and alarm summary bar. Title bar shall be displayed on the top of each screen and include display name, description and time/date. The main graphical area shall contain primary screen data in graphical format. Navigational buttons shall include a minimum of main menu, trends, main alarm summary, and security log in. The alarm summary bar shall display the last three valid alarms on the bottom of each screen.
- E. Animation shall be provided to mimic level changes in tanks or vessels, and to mimic rotation of rotating equipment when running. Valve colors shall change when opened and closed.
- F. Unless specifically noted, all timers, setpoints, alarm actuation levels, etc., shall be adjustable from the operator interface.
- G. The system shall show field conditions with text that can alternate (i.e., OPEN/CLOSE, START/STOP, HIGH/LOW) and change color correspondingly. Field devices that are tri state must be represented in three conditions.
- H. Conditions in the field designated as alarm conditions shall report to the operator workstation, actuate an audible alarm, and provide a visual blinking image on the associated graphic page. All alarms and events should be displayed on the screen and archived.
- I. All interlocks that affect equipment operation shall be identified both by alarm and by HMI indication.
- J. All analog inputs shall be checked for out of range (via high and low limit checks) and alarmed.
- K. All process flow streams shall be labeled and color coded using the project color schedule in Division 9. All structures and equipment shall be identified by name and appropriate equipment and loop tags.
- L. Color coding for equipment status and alarms shall be as follows:
 - 1. Red for on or open.
 - 2. Green for off or closed.
 - 3. Active, unacknowledged alarms are indicated by flashing amber.
 - 4. Active, acknowledged alarms are indicated solid amber.
- M. Automatically record all alarm and events should any of the following sequences or events occur:
 - 1. Date/Time entry
 - 2. Limit changes

3. Any commanded or un-commanded change of any point
 4. Alarm conditions
 5. PLC activation or deactivation
 6. Operator login or logout activity
- N. There may be additional general programming requirements listed in PART 1 of the Section 13305 control descriptions section that impact the HMI configuration.

3.4 SPECIFIC GRAPHIC SCREENS

- A. At a minimum, provide the following types of graphic screen indicated below.
1. Plant Overview screen shall include a site plan representation, indicating the geographic location of each process, and each building.
 2. Main menu screen shall be developed to link to all screens and process areas. The screen shall be a complete and logical listing of the names and number of all screens
 3. Overall plant process block flow diagram screen shall show all major processes in block form with flow arrows. Each block shall include a text description of key individual treatment processes. Navigational buttons to the individual treatment processes shall be performed by pressing on the text description.
 4. Individual treatment process screens shall graphically screen key process variables and equipment. No operator entries shall be done from these screens. Individual process flow screens for each process shall include all process components, including tanks, pumps, blowers, mixers, drives, flow meters, valves, mechanical devices, as well as manual shutoff and isolation valves. These diagrams shall be generally depicted from the P&ID's and there shall be at least 1 screen per P&ID on average.
 5. Individual unit process screens depicted from the P&ID's are used for control and screen of each major item of process equipment, process variables, and control devices, including pumps, blowers, valves, gates, mixers, drives etc. Navigational buttons shall consist of the P&ID's flow arrows to other individual unit processes. The unit process screens shall provide the ability for the operator to go to individual equipment popup screens. These diagrams shall be generally depicted from the P&ID's and there shall be at least 2 screens per P&ID on average.
 6. Popup screens shall be provided for each piece of equipment to start/stop equipment, open / close valves, implement automatic control, adjust set points, establish and adjust tuning parameters, set alarm limits and initiate a sequence.
 7. PLC system diagnostic screens, showing the operational status, and fault conditions of all PLC components, including processors, I/O modules, OIT's, power supplies and UPS units.
 8. Communications diagnostic screens, showing the details of network status, communications status of all major components including Operator Work Stations, peripheral devices and network components.
 9. Maintenance screens shall screen the raw value for each analog and digital I/O point in the system. They shall also allow the operators/maintenance personnel to enter an override value for an analog point that is then used by the system instead of the value read from the input card / communications link.

10. Trend screens with the capability to screen up to eight, operator assigned, analog and/or digital process variables. Each analog value will be shown on a trend screen.
11. Main alarm summary screen shall screen the following information on each alarm: Time, tag name, description, alarm type, current value and status. An acknowledge alarm button shall acknowledge all new unacknowledged alarms. The acknowledged and unacknowledged alarms shall be different colors. Acknowledged alarms shall clear automatically after the condition is corrected.
12. Analog variable screens showing a tabular summary of all plant process variables, in operator assigned groupings.

3.5 SECURITY

- A. N/A

3.6 ALARM/EQUIPMENT STATUS REPORTING

- A. The alarm log shall display all alarms as they occur. The alarm message shall include the time of occurrence, tag name, tag number, and whether it is a low, high, or failure alarm. When the point in alarm returns to normal, the time, point identification number, and return to normal shall be displayed. All reports shall include the plant equipment number of the associated device.
- B. The equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The equipment status log shall include the time, equipment name, tag number, and the particular change in status.

3.7 HISTORICAL DATA MANAGEMENT

- A. N/A

3.8 REPORTS

- A. N/A

3.9 TESTING

- A. Refer to section 13302.
- B. Supplement to Field Testing requirements
 1. Prior to leaving the site, use the Owner's programming computer to monitor all PLC processors online, make on-line changes, upload and download the processor to ensure programming software version compatibility.

3.10 TRAINING

- A. Refer to Section 13303 for general training requirements
- B. Furnish training as shown in the table below.

Description	Minimum Course Duration (hours)	Maximum Number of Trainees per Course	Number of Times Course to be Given	Intended Audience
Onsite Training				
Control System Overview Seminar	2	4	1	Management
Operator Training (Pre start-up)	8	4	1	Operations
Operator Training (Post start-up)	8	4	1	Operations

- C. Control System Overview Seminar
 - 1. Provide Control System Overview seminar for the Owner's personnel at the Owner's facility. The objective of this seminar is to provide personnel with an overview understanding of the Control System. The seminar material shall be targeted to the Owner's management, engineering, and other non-operations personnel. The seminar shall include, but not limited to, the following:
 - a. An overview of the Control system explaining how the hardware and software supplied under this Contract is used for the operation and control of the facilities.
 - b. A block diagram presentation of the Control system showing how and what information flow within the system and what each functional unit does.
 - c. An explanation of the operator interfaces including a demonstration of how to use an operator's workstation to monitor, control, navigate, display trends, and all other operational features of the system. Discussion of process control of individual processes shall be addressed outside of this course.
 - d. A walkthrough of the installed system explaining each of the items covered in the functional units' discussion. The features and functions of operator controls and interfaces shall be discussed.
- D. Operator Control System Training (pre or post start-up)
 - 1. Operator training shall cover plant operation with the control system and use of the HMI display screens, including at a minimum all the following items:
 - a. Basics of HMI control and navigation
 - b. Alarming and Interlocks
 - c. Auto functionality of automated processes and HMI control.
 - d. Failure modes of equipment and operator responses.
 - 2. One operator training sessions (Pre-Startup) for operators shall be held 1 week before system startup. The pre-startup training shall make use of the Simulator specified in this project. Additional one or two operator training sessions (Post-Startup) for operators shall be held one week after system startup.

3. Operator training shall be held at the convenience of the OWNER. This training may be held during the day, late at night, or very early in the morning to accommodate the OWNER'S shift schedule.
 4. Operator training shall be introductory in nature during pre-startup training and more in-depth and detailed during post-startup training.
 5. At a minimum, the following teaching aids shall be available for distribution during Operator training sessions:
 - a. Preliminary O&M Manuals (pre-startup); Final O&M Manuals (post-startup).
 - b. P&IDs.
 - c. Daily syllabus.
 6. Fifty percent of all Operator training shall be "hands on" utilizing the installed Control System to the fullest extent possible. Confirm the operability of the Control System before commencing training. Training performed using a non-functioning Control System shall be rejected and repeated.
- E. Software Maintenance
1. N/A
- F. Historian and System Reports
1. N/A

END OF SECTION 13306

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SECTION 13330

CONTROL PANELS AND PANEL MOUNTED EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Refer to Section 13300.
- B. Furnish and install control panels and panel mounted equipment as specified herein and shown on the Drawings.
- C. All new panels and panel components shall match existing equipment makes and models wherever possible, so that system additions can be most easily integrated with respect to operation and maintenance training, spare parts inventory, and service contracts. Even when exact matches are not possible, equipment furnished must be fully compatible with the existing system. Color, size, and material of new panels should conform to that of existing panels.

1.2 RELATED WORK

- A. Refer to Section 13300.

1.3 SUBMITTALS

- A. Refer to Section 13300.
- B. Descriptive literature, bulletins, catalog cuts and Drawings for the equipment specified herein.
- C. Complete bill of materials for the equipment.
- D. Spare parts list.
- E. Panel Layout Drawings and Wiring Diagrams Submittal
 - 1. Where direct hardwired interfaces exist between the PCSS control panels and vendor provided control panels furnished under other Divisions, the Contractor shall provide to the PCSS the approved submittals in order for the PCSS to provide complete wiring diagrams showing all wiring connections in the I/O system. This includes but is not limited to terminal block numbering, relay contact information, instruments, equipment, and control panel names. These drawings shall be included in the Final O&M submittal. Leaving this information blank on the Final Documentation drawings is not acceptable.

2. Panel Layout Drawings: Drawings shall be furnished for all panels, consoles, and equipment enclosures specified. Panel assembly and elevation drawings shall be drawn to scale and detail all equipment in or on the panel. Panel drawings shall be 11"x17" in size. At a minimum, the panel drawings shall include the following:
 - a. Interior and exterior panel elevation drawings to scale.
 - b. Nameplate schedule.
 - c. Conduit access locations.
 - d. Panel construction details.
 - e. Cabinet assembly and layout drawings to scale. The assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.
 - f. Fabrication and painting specifications including color (or color samples).
 - g. Construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.
 - h. For every control panel, heating and cooling calculations for each panel supplied indicating conformance with cooling requirements of the supplied equipment and environmental conditions. Calculations shall include the recommended type of equipment required for both heating and cooling.
 - i. Submit evidence that all control panels shall be constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application shall be accomplished at the fabrication location or by field inspection by UL inspectors. All costs associated with obtaining the UL seal and any inspections shall be borne by the Contractor.
3. Panel Wiring Diagrams: Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. If ISA Loop Wiring Diagrams are specified below, equipment external to the control panel and related external connections do not need to be shown on the Panel Wiring Diagrams. Panel wiring diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering. Field device wiring shall include the device ISA-tag and a unique numeric identifier. The diagrams shall identify all device terminal points that the system connects to, including terminal points where I/O wiring lands on equipment not supplied by the PCSS. Wiring labeling used on the drawings shall match that shown on the Contract Documents or as developed by the PCSS and approved by the Engineer. I/O wiring shall be numbered with rack number, slot number, and point number. Two-wire and four-wire equipment shall be clearly identified and power sources noted. Submit final wire numbering scheme. Panel drawings shall be 11" x17" in size.
4. ISA Loop Wiring Diagrams: Not required

1.4 COORDINATION MEETINGS

- A. Refer to Section 13300.

1.5 REFERENCE STANDARDS

- A. Refer to Section 13300.

1.6 QUALITY ASSURANCE

- A. Refer to Section 13300.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 13300.

1.8 NOMENCLATURE AND IDENTIFICATION

- A. Refer to Section 13300.

1.9 MAINTENANCE

- A. Refer to Section 13300.
- B. Test Equipment:
 - 1. Refer to Section 13300.

1.10 WARRANTY

- A. Refer to Section 13300.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Section 13300

2.2 LIGHTNING/SURGE PROTECTION

- A. Refer to Section 13300.

2.3 CONTROL PANEL GENERAL REQUIREMENTS

- A. The dimensions within this Section and on the Contract Drawings are for general reference only. Ensure that final enclosure sizing and panel arrangements accommodate

all required equipment for a fully integrated and operational system as specified herein and in the Contract Documents.

- B. Each control panel and terminal cabinet shall bear the UL label. The UL label shall apply to the enclosure, the specific equipment supplied with the enclosure, and the installation and wiring of the equipment within and on the enclosure. If required for UL labeling, provide ground fault protective devices, isolation transformers, fuses and any other equipment necessary to achieve compliance with UL 508 requirement. The Drawings do not detail all UL 508 requirements.
- C. All panel doors shall have a lock installed in the door handle, or a hasp and staple for padlocking. Locks for all panels provided under this Contract shall be keyed alike.
- D. The devices designated for rear-of-panel mounting shall be arranged within the panel according to respective panel drawings and in a manner to allow for ease of maintenance and adjustment. Heat generating devices such as power supplies shall be located at or near the top of the panel.
- E. The panels shall be completely fabricated, instruments and devices installed and wired at the PCSS's facility.
- F. All components shall be mounted in a manner that shall permit servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with manufacturer's recommendations. The internal components shall be identified with suitable plastic or metal engraved nametags mounted adjacent to (not on) each component identifying the component in accordance with the drawing, specifications, and PCSS's data.
- G. All exterior panel mounted equipment shall be installed with suitable gaskets, faceplates, etc. required to maintain the NEMA rating of the panel.
- H. Nameplates
 - 1. All panels and panel devices shall be supplied with suitable nameplates, which identify the panel and individual devices as required. Unless otherwise indicated, each device nameplate shall include up to three lines with the first line containing the device tag number as shown on the drawings, the second line containing a functional description (e.g., Recirculation Pump No. 1), and the third line containing a functional control description (e.g., Start).
 - 2. Unless escutcheon plates are specified or unless otherwise noted on the Drawings, nameplates shall be 3/32-inch thick, black and white, Lamicoid with engraved inscriptions. The letters shall be Black [White] against a White [Black] background unless otherwise noted. Edges of the nameplates shall be beveled and smooth. Nameplates with chipped or rough edges will not be acceptable.

3. Nameplate fasteners and mounting shall be epoxy adhesive or stainless steel screws for cabinet mounted nameplates
4. For every panel, provide a panel nameplate with a minimum of 1" high letters. Provide legend plates or 1-in by 3-in engraved nameplates with 1/4-in lettering for identification of door mounted control devices, pilot lights, and meters.
5. Single lamicoid nameplates with multiple legends shall be used for grouping of devices such as selector switches and pilot lights that relate to one function.

I. Mounting Elevations

1. ISA Recommended Practice RP60.3 shall be used as a guide in layout and arrangement of panels and panel mounted components. Dimensions shall account for all housekeeping pads that panels will sit on once they are installed.
2. Centerline of indicators and controllers shall be located no lower than 48-inches or higher than 66-inches above the floor on a panel face.
3. Centerline of lights, selector switches, and pushbuttons shall be located no lower than 32-inches or higher than 70-inches above the floor on a panel face.
4. Tops of annunciators shall be located no higher than 86-inches above the floor on a panel face.
5. Installation of panel components shall conform to component manufacturers' guidelines.

2.4 PANEL MATERIALS AND CONSTRUCTION

A. Structure and Enclosure

1. Panels shall be of continuous welded-steel or FRP construction as shown on the Panel Schedule. Provide angle stiffeners as required on the back of the panel face to prevent panel deflection under instrument loading or operation. Internally the panels shall be supplied with a structural framework for instrument support purposes and panel bracing. The internal framework shall permit panel lifting without racking or distortion. Provide removable lifting rings designed to facilitate simple, safe rigging, and lifting of the control panels during installation.
2. Each panel shall be provided with full height, fully gasketed access doors where shown. Doors shall be provided with a three-point stainless steel latch (except for NEMA 4X panels) and heavy duty stainless steel locking handle. Rear access doors (if included) shall be conveniently arranged and sized such that they extend no further than 24-inches beyond the panel when opened to the 90-degree position. Front and side access doors shall be as shown. Panel access doors shall be provided with full length, continuous, piano type stainless steel hinges with stainless steel pins. Front access doors with mounted instruments or control devices shall be of sufficient width to permit door opening without interference from flush mounted instruments.
3. The panels, including component parts, shall be free from sharp edges and welding flaws. Wiring shall be free from kinks and sharp bends and shall be routed for easy access to other components for maintenance and inspection purposes.
4. The panel shall be suitable for top and bottom conduit entry as required by the Electrical Drawings. For top mounted conduit entry, the panel top shall be provided

with nominal one-foot square removable access plates, which may be drilled to accommodate conduit and cable penetrations. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts, and other accessories as required to maintain the NEMA rating of the panel and electrical rating of the conduit system.

5. All panels in indoor, dry, non-corrosive environments shall be NEMA 12 unless otherwise noted. All panels in outdoor, wet, and non-chemically corrosive environments shall be NEMA 4 unless otherwise noted. Panels in chemically corrosive environments shall be NEMA 4X unless otherwise noted. All panels located in a hazardous location shall be rated for the type of hazard (e.g., NEMA 7 for Class 1, Division 1).

B. Freestanding and Floor-Mounted Vertical Panels

1. Freestanding and floor-mounted vertical panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of 12 gauge sheet steel, suitably braced internally for structural rigidity and strength. All NEMA 4X rated panels shall be constructed of 316 stainless steel, unless FRP is specifically indicated to be provided. Front panels or panels containing instruments shall be not less than 10 gauge stretcher leveled sheet steel, reinforced to prevent warping or distortion.

C. Wall and Unistrut Mounted Panels

1. All wall and Unistrut mounted panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of not less than USS 14 gauge steel, suitably braced internally for structural rigidity and strength. All NEMA 4X rated wall mounted panels shall be constructed of 316 stainless steel, unless FRP is specifically indicated. FRP panels shall be used in chlorine areas. All FRP panels located in direct sunlight shall be provided with a protective coating and sun shield to prevent discoloration and cracking.

D. Finish Requirements

1. All sections shall be descaled, degreased, filled, ground and finished. The enclosure when fabricated of steel shall be finished with two rust resistant phosphate prime coats and two coats of enamel, polyurethane, or lacquer finish which shall be applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel, and FRP panels will not require a paint finish.
2. The panels shall have edges ground smooth and shall be sandblasted and then cleaned with a solvent. Surface voids shall be filled and ground smooth.
3. Immediately after cleaning, one coat of a rust-inhibiting primer shall be applied inside and outside, followed by an exterior intermediate and top coat of a two-component type epoxy enamel. A final sand-ing shall be applied to the intermediate exterior coat before top coating.
4. Apply a minimum of two coats of manufacturer's standard, flat light-colored lacquer, on the panel interior after priming.
5. Unless otherwise noted, the finish exterior colors shall be ANSI 61 gray with a textured finish.

- E. Print storage pockets shall be provided on the inside of each panel. The storage pockets shall be steel, welded on to the door, and finished to match the interior panel color. The storage pocket shall be sufficient to hold all of the prints required to service the equipment, and to accommodate 8.5 inch by 11 inch documents without folding.
- F. Where specified on the Panel Schedule, a folding shelf shall be provided on the inside of the door on all free-standing and floor-mounted panels. The shelf shall be suitable for a laptop computer and shall be placed such that an open laptop computer does not interfere with any door-mounted devices. The folded shelf shall not interfere with any internal panel components when the door is closed. The folding shelf shall automatically lock in the horizontal position when raised. The folding shelf shall be approximately 18 inches wide by 12 inches deep and shall have a minimum distributed load rating of 100 pounds. All parts shall be made of heavy gauge steel and shall be painted white or finished to match the interior panel color.

2.5 ENVIRONMENTAL CONTROL

- A. N/A

2.6 CORROSION CONTROL

- A. Panels shall be protected from internal corrosion by the use of corrosion-inhibiting vapor capsules as manufactured by Northern Technologies International Corporation, Model Zerust VC ; Hoffman Model AHCI; or approved equal.

2.7 CONTROL PANEL - INTERNAL CONSTRUCTION

- A. Internal Electrical Wiring
 - 1. All interconnecting wiring shall be stranded, type MTW, and shall have 600 volt insulation and be rated for not less than 90 degrees Celsius. Wiring for systems operating at voltages in excess of 120 VAC shall be segregated from other panel wiring either in a separate section of a multi-section panel or behind a removable Plexiglas or similar dielectric barrier. Panel layout shall be developed such that technicians shall have complete access to 120 VAC and lower voltage wiring systems without direct exposure to higher voltages.
 - 2. Power distribution wiring on the line side of fuses or breakers shall be 12 AWG minimum. Control wiring on the secondary side of fuses shall be 16 AWG minimum. Electronic analog circuits shall utilize 18 AWG shielded, twisted pair, cable insulated for not less than 600 volts.
 - 3. Power and low voltage DC wiring systems shall be routed in separate wireways. Crossing of different system wires shall be at right angles. Different system wires routed parallel to each other shall be separated by at least 6-inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs shall not be filled to more than 60 percent visible fill.
 - 4. Terminations

- a. All wiring shall terminate onto single tier terminal blocks, where each terminal is uniquely and sequentially numbered. Direct wiring between field equipment and panel components is not acceptable.
 - b. Multi-level terminal blocks or strips are not acceptable unless they are approved by the Engineer. If approved, they shall be mounted on angled din rail elevated from the back panel.
 - c. Terminal blocks shall be arranged in vertical rows and separated into groups (power, AC control, DC signal). Each group of terminal blocks shall have a minimum of 25 percent spares.
 - d. Terminal blocks shall be the compression type, fused, unfused, or switched as shown on the Contract Drawings or specified elsewhere in Division 13.
 - e. Discrete inputs and outputs (DI and DO) shall have two terminals per point with adjacent terminal assignments. All active and spare PLC and controller points shall be wired to terminal blocks.
 - f. Analog inputs and outputs (AI and AO) shall have three terminals per shielded pair connection with adjacent terminal assignments for each point. The third terminal is for shielded ground connection for cable pairs. Ground the shielded signal cable at the PLC cabinet. All active and spare PLC and controller points shall be wired to terminal blocks.
 - g. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers.
 - h. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6-inches of the side panel or adjacent terminal or within 8-inches of the bottom of free standing panels, or within 3-inches of stanchion mounted panels, or 3-inches of adjacent wireway.
 - i. Circuit power from the SCADA cabinet out to field devices (switches, dry contacts etc.) that are used as discrete inputs to the PLC input cards shall be isolated with an isolating switch terminal block with flip cover that is supplied with a dummy fuse. Isolation switch block shall be an Allen Bradley Model 1492-H7 or approved equal. One isolating switch terminal block per loop numbered piece of equipment and one per spare I/O point is acceptable.
 - j. All PLC discrete outputs to the field shall be isolated with an isolating fuse switch terminal block with a flip cover and a neon blown fuse indicator. The single circuit fusible terminal block shall be an Allen Bradley 1492-H4 or approved equal.
- 5. All wiring to hand switches and other devices, which are live circuits independent of the panel's normal circuit breaker protection, shall be clearly identified as such.
 - 6. All wiring shall be clearly tagged and color coded. All tag numbers and color coding shall correspond to the panel wiring diagrams and loop drawings prepared by the PCSS. All power wiring, control wiring, grounding, and DC wiring shall utilize different color insulation for each wiring system used. The color coding scheme shall be:
 - a. Incoming 120 VAC Hot - Black
 - b. 120 VAC Hot wiring downstream of panel circuit breaker – Red
 - c. 120 VAC Hot wiring derived from a UPS system – Red with Black stripe

- d. Three phase power – Brown, Orange, Yellow, and Green ground or as specified in Division 16.
 - e. 120 VAC neutral - White
 - f. Ground - Green
 - g. DC power or control wiring – Blue
 - h. DC analog signal wiring – Black (+), White (-)
 - i. Foreign voltage – Yellow
7. Provide surge protectors on all incoming power supply lines at each panel per the requirements of Section 13300.
 8. Each field instrument furnished under Division 13 and shown on the Drawings as deriving input power from the control panel(s) shall have a separate power distribution circuit with a circuit breaker or fuse and blown fuse indication. All instruments requiring 120VAC power shall be powered from the UPS source in the panel where the instrument signals lands.
 9. Provide redundant 24 VDC power supplies to power field instruments and panel devices. Twenty-four VDC power supplies shall be as specified in this Section.
 10. Wiring trough for supporting internal wiring shall be plastic type with snap-on covers. The side walls shall be open top type to permit wire changing without disconnecting. Trough shall be supported to the subpanel by stainless steel screws. Trough shall not be bonded to the panel with glue or adhesives.
 11. Each panel shall have a single tube, fluorescent light fixture, 20 Watt in size, mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.
 12. Each panel shall have a specification grade duplex convenience receptacle with ground fault interrupter, mounted internally within a stamped steel device box with appropriate cover. Convenience receptacle shall not be powered from a UPS and shall be protected by a dedicated fuse or circuit breaker.
 13. Each panel shall be provided with an isolated copper grounding bus for all signal and shield ground connections. Shield grounding shall be in accordance with the instrumentation manufacturer's recommendations.
 14. Each panel shall be provided with a separate copper power grounding bus (safety) in accordance with the requirements of the National Electrical Code.
 15. Each panel shall have control, signal, and communication line surge suppression in accordance with Section [13300] [40 90 00].
 16. All microprocessor-based electronic devices in the panel that are powered by 120VAC shall be powered by the UPS (refer to appropriate Section in Division 13).
 17. Each panel shall be provided with a circuit breaker to interrupt incoming power.
 18. Additional electrical components including transformers, motor starters, switches, circuit breakers, etc. shall be in compliance with the requirements of Division 16.

B. Pneumatic Tubing

1. Refer to Section 13300.
2. Pneumatic tubing shall be a minimum of 1/4-inch O.D. 316 stainless steel with compression fittings. All tubing shall be rigidly supported and run in horizontal or vertical planes.
3. All pneumatic equipment shall be provided with separate shut-off valves. Flexible polyethylene tubing shall be used on all devices mounted on hinged doors, etc.

4. A screened vent shall be provided on all enclosures using pneumatic instruments.
 5. All pneumatic tubing shall be routed in separate bundles or wireways, and shall be separated from all electrical wiring by a minimum of 3-inches.
- C. Relays not provided under Division 16 and required for properly completing the control function specified in Division 13, Division 16, or shown on the Drawings shall be provided under this Section.
 - D. The orientation of all devices including PLC and I/O when installed shall be per the manufacturer's recommendations. No vertical orientation of PLC racks shall be allowed unless specifically indicated by the manufacturer as an acceptable mounting alternative and also approved by the engineer.

2.8 ELECTRICAL COMPONENTS

- A. The main circuit breaker shall be a thermal-magnetic molded case breaker, by Square D Company, or approved equal. Provide a flange mounted main power disconnect operating handle with mechanical interlock having a bypass that will allow the panel door to open only when the switch is in the OFF position.
- B. A mechanical disconnect mechanism, with bypass, shall be installed on each motor circuit protector, capable of being locked in the "OFF" position to provide a means of disconnecting power to the motor.
- C. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein and as required by the detailed mechanical equipment requirements, the P&IDs (Division 13), the Control Wiring Diagrams (Division 16) and as shown on the Drawings.
- D. All operating control devices and instruments shall be securely mounted on the exterior door. All controls shall be clearly labeled to indicate function and shall be in accordance with the electrical area classification indicated on the Electrical Contract Drawings.
- E. A six digit, non-resettable quartz time base elapsed time meter shall be connected to each motor starter. Meter shall be Hobbs 98000 Series, Redington Model 722, Cramer Model ETI-635 G, or approved equal.
- F. The control panel shall be provided with a lightning and surge protection unit on the line side of the main circuit breaker. Unit shall be 600 Volt, 3 Phase, General Electric "Tranquell" Series, or approved equal.
- G. Where required by Specifications, an alternator shall be provided to sequence motors. Alternator shall be Catalog No. 008-120-13SP or 009-120-23AP by Stacon; Square D, Class 9039, Type HG-21 or approved equal.

- H. Panel mounted timers shall be flush mounted, plug-in type, Eagle Signal Bulletin 125 cycle-flex, Idec SR6P-MO8G or approved equal, with ranges as shown on the Drawings, or as required by the detailed mechanical equipment specifications.
- I. Specific control devices, control descriptions and other data are specified under the detailed specification for the mechanical equipment with which the control panel is supplied.

2.9 INDICATOR, BAR GRAPH

- A. Type: Electronic bar graph; nominal 4 inch vertical scale and digital indicator.
- B. Operation: To accept 4-20 mA DC input signal and provide an indication of measured variable on a vertical scale; microprocessor based with solid state circuitry; 101 segment bar graph and digital readout.
- C. Functional:
 - 1. Input: 4-20 mA DC into 250 OHMS maximum.
 - 2. Indication: 4 inch scale graduated in engineering units.
- D. Physical:
 - 1. Case size: nominal 1 inch x 6 inch
 - 2. Case type: dust and moisture resistant (NEMA 4X)
 - 3. Mounting: flush panel suitable for high density mounting arrangements.
- E. Performance: Accuracy (bar graph) plus or minus 2.0 percent; (digital indicator) plus or minus 0.1 percent of span.
- F. Manufacturer(s):
 - 1. Ametek Dixson.
 - 2. Foxboro.
 - 3. Moore Products.
 - 4. Or Approved Equal.

2.10 PILOT TYPE INDICATING LIGHTS

- A. Type: Energy efficient Solid State LED Lamps.
- B. Functional:
 - 1. Units shall be provided with low voltage LED lamps suitable for the voltage supplied.
 - 2. Lights supplied with 120V AC power shall have integral reduced voltage transformers.
 - 3. Lamps shall be replaceable from the front of the unit.
- C. Physical:

1. Lens color:
 - a. Running, on, open – Red.
 - b. Stopped, off, closed – Green.
 - c. Alarm – Amber.
 - d. White - Power on
 - e. Blue - All other status indications not covered by the above
 - f. Lens caps shall be approximately .46-inch diameter. Provide legend faceplates engraved to indicate the required function of each device; NEMA rating - 4X.

- D. Manufacturer(s):
1. Cutler-Hammer.
 2. Allen Bradley.
 3. General Electric.
 4. Square D.
 5. Crouse Hinds (NEMA 7).
 6. Or Approved Equal.

2.11 SELECTOR SWITCHES AND PUSHBUTTONS

- A. Type:
1. Control devices shall be heavy-duty oil tight type with stackable contact blocks.
- B. Functional:
1. Provide contact arrangement and switching action as required for the control system specified.
- C. Physical:
1. For 120 VAC service provide contacts rated 10 amps at 120 VAC, for 24 VDC service provide silver sliding contacts rated 5 amps at 125 VDC, for electronic (millivolt/ milliamp) switching provide contacts rated lamp at 28 VDC.
 2. Pushbuttons shall have flush type operators.
 3. Selector switches shall have knob or wing lever operators; NEMA rating - 4X; Provide legend plates denoting switch/pushbutton position/ function.
- D. Manufacturer(s):
1. Cutler-Hammer.
 2. Allen Bradley.
 3. General Electric.
 4. Square D.
 5. Crouse Hinds (NEMA 7).
 6. Or Approved Equal.

2.12 POTENTIOMETER

- A. Type:

1. Device shall be heavy-duty 30 mm oil tight type.
- B. Functional:
 1. 270 degree dial
 2. Rated for 1,000 ohms.
- C. Physical:
 1. Mounting: Suitable for panel mounting
 2. NEMA 4X rating; escutcheon plates scaled in engineering units.
- D. Manufacturer(s):
 1. Allen Bradley Co.
 2. Cutler-Hammer.
 3. Square D.
 4. Or Approved Equal.

2.13 GENERAL PURPOSE RELAYS AND TIME DELAYS

- A. Type:
 1. General purpose plug-in type.
- B. Functional:
 1. Contact arrangement/function shall be as required to meet the specified control function; Mechanical life expectancy shall be in excess of 10 million.
 2. Duty cycle shall be rated for continuous operation; Units shall be provided with integral indicating light to indicate if relay is energized.
 3. Solid state time delays shall be provided with polarity protection (DC units) and transient protection.
 4. Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.
- C. Physical:
 1. For 120 VAC service provide contacts rated 10 amps at 120 VAC, for 24 VDC service provide contacts rated 5 amps at 28 VDC, for electronic (milliamp/millivolt) switching applicator provide gold plated contacts rated for electronic service; relays shall be provided with dust and moisture resistant covers.
- D. Options/Accessories Required:
 1. Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.
 2. Provide mounting rails/holders as required.
- E. Manufacturer(s):
 1. Allen Bradley.
 2. Potter & Brumfield.
 3. Or Approved Equal.

2.14 SIGNAL RELAY SWITCHES (CURRENT TRIPS)

- A. Type:
 - 1. Solid state, ASIC technology, electronic type.
- B. Functional:
 - 1. Input: 4-20 mA.
 - 2. Output: Isolated contact output, double pole double throw, rated 5 amps at 120 VAC.
 - 3. Accuracy: 0.1 percent.
 - 4. Protection: Provide RFI protection.
 - 5. Deadband: Adjustable between 0.1 and 5.0 percent of span.
 - 6. Set point Adjustment: Single Point alarms shall be adjustable to trip on rising or falling input signal, dual point alarms shall be adjustable to trip on rising and falling input signals.
 - 7. Repeatability: Trip point repeatability shall be at least 0.1 percent of span.
- C. Physical:
 - 1. Mounting: DIN rail.
- D. Manufacturer(s):
 - 1. Action Instruments Slim Pak.
 - 2. Acromag.
 - 3. Or Approved Equal.

2.15 SIGNAL ISOLATORS/BOOSTERS/CONVERTERS

- A. Type:
 - 1. Solid state, ASIC technology; electronic type.
- B. Functional:
 - 1. Accuracy: 0.15 percent.
 - 2. Inputs: Current, voltage, frequency, temperature, or resistance as required.
 - 3. Outputs: Current or voltage as required.
 - 4. Isolation: There shall be complete isolation between input circuitry, output circuitry, and the power supply.
 - 5. Adjustments: Zero and span adjustment shall be provided.
 - 6. Protection: Provide RFI protection.
- C. Physical:
 - 1. Mounting: DIN Rail.
- D. Manufacturer(s):
 - 1. Action Instruments Slim Pak.
 - 2. Acromag.
 - 3. Or Approved Equal.

2.16 SIGNAL SELECTORS, COMPUTATION, AND CONDITIONING RELAYS

- A. Type:
 - 1. Solid state, ASIC technology, electronic type.
- B. Functional:
 - 1. Inputs: 4-20 mA.
 - 2. Outputs: 4-20 mA.
 - 3. Protection: Provide RFI protection.
 - 4. Operation: The relay shall multiply, add, subtract, select, extract the square root, or perform the specified conditioning/ computation function required. All inputs shall be able to be individually rescaled and biased as required.
 - 5. Isolation: All inputs, outputs, and power supplies shall be completely isolated.
 - 6. Accuracy: 0.35 percent of span.
 - 7. Adjustments: Multi turn potentiometer for zero, span, scaling, and biasing.
- C. Physical:
 - 1. Mounting: DIN rail.
- D. Manufacturer(s):
 - 1. Action Instruments Slim Pak.
 - 2. Acromag.
 - 3. Or Approved Equal.

2.17 INTRINSIC SAFETY BARRIERS

- A. Type:
 - 1. Barriers shall be of the solid state electronic type in which the energy level of the sensing or actuation circuit is low enough to allow safe usage in hazardous areas.
 - 2. Provide a barrier for instrumentation and equipment transmitting analog or digital signals that originate in a hazardous area as indicated in the design documents.
- B. Options Required:
 - 1. Barriers shall match power supply provided.
 - 2. Barriers shall be located in non-hazardous areas.
- C. Manufacturer(s):
 - 1. Siemens Water Technologies – IS1 (4-20mA) and IS6 (dry contacts)
 - 2. Gems – 54800 (4-20mA) and 65800 (dry contacts)
 - 3. R. Stahl - Intrinspak
 - 4. Or Approved Equal.

2.18 EMERGENCY ALARM BEACON AND AUDIBLE HORN

- A. Beacon alarm light:
 - 1. Type:

- a. Beacon alarm light.
- 2. Physical:
 - a. Beacon alarm light for building exterior mounting shall be 120 VAC, flush mounted, weatherproof construction.
 - b. A 750,000-candle power xenon strobe tube and red polycarbonate lens.
- 3. Manufacturer(s):
 - a. Federal Signal.
 - b. Edwards.
 - c. Wheelock.
 - d. Or Approved Equal.

B. Alarm Horn:

- 1. Type:
 - a. Alarm horn shall be vibrating type for 120 Volts, 60 Hz.
- 2. Manufacturer(s):
 - a. Federal Signal Corp.
 - b. Edwards Co.
 - c. Benjamin.
 - d. Or Approved Equal.

2.19 INTRINSIC SAFETY BARRIERS (FOR 2-WIRE TRANSMITTER SYSTEMS)

- A. Intrinsic safety barriers shall be passive devices requiring no external voltage supply and supplied with series resistors, series fuse and shunt zener diodes to limit the transfer of energy to levels required by intrinsically safe protection between safe and hazardous locations.
- B. Unit shall be Factory Mutual approved and certified for use in accordance with National Fire Protection Association (NFPA 493).
- C. Manufacturer(s):
 - 1. P&F.
 - 2. Gems.
 - 3. Unitech.
 - 4. Or Approved Equal.

2.20 24 VDC POWER SUPPLIES

- A. Provide a 24 VDC power supply in the control panel to power field instruments, panel devices, etc., as required. Equip the power supply with a power on/off circuit breaker.
- B. The 24 VDC power supply shall meet the following requirements:
 - 1. Input power: 115 VAC, plus or minus 10 percent, 60 Hz.
 - 2. Output voltage: 24 VDC.
 - 3. Output voltage adjustment: 5 percent.
 - 4. Line regulation: 0.05 percent for 10 volt line change.

5. Load regulation: 0.15 percent no load to full load.
 6. Ripple: 3 mV RMS.
 7. Operating temperature: 32 to 140 degrees Fahrenheit.
- C. Size the 24 VDC power supply to accommodate the design load plus a minimum 25 percent spare capacity.
- D. If power supply on/off status signal is shown, provide a relay contact (internal to the power supply or external if the power supply is not so equipped) to indicate on/off status of the power supply.
- E. Provide output overvoltage and overcurrent protective devices with the power supply to protect instruments from damage due to power supply failure and to protect the power supply from damage due to external failure.
- F. Mount the 24 VDC power supply such that dissipated heat does not adversely affect other panel components.
- G. Manufacturer(s):
1. Acopian.
 2. Lambda.
 3. Or Approved Equal.

2.21 DIGITAL PANEL METER

- A. Type:
1. Electronic, 3.5 digit, 0.56-inch high efficiency LED display.
- B. Operation:
1. To accept 4-20 mA DC input signal and provide indication in Engineering Units of measured variable.
- C. Functional:
1. Power supply: 115 VAC, plus or minus 10 percent, 50/60 Hz, 10 VA.
 2. Input: 4-20 mA DC into 100 ohms.
 3. Indication: 0.56 inch LED display.
- D. Physical:
1. Case size nominal 2.5-inch high by 5-inch wide by 6-inch deep.
 2. Case type: watertight and dust-tight (NEMA 4X).
 3. Mounting: flush panel suitable for high density mounting arrangements.
- E. Performance: Linear input accuracy plus or minus 0.05 percent of calibrated span, plus or minus 1 count.
- F. Manufacturer(s):
1. Precision Digital.

2. Red Lion.
3. Or Approved Equal.

2.22 SPARE PARTS

- A. General requirements for spare parts are specified in section 13300.
- B. The following control panel spare parts shall be furnished:
 1. Timers and sockets - Two of each type installed.
 2. Relays and sockets - Two of each type installed.
 3. Fuses and circuit breakers - 10% (minimum of 10 fuses and 2 circuit breakers) of each type and size installed.
 4. Light bulbs - 10% (minimum of 10) of each type installed. For LED type lights, 5% (minimum of 3) of each color installed.
 5. Panel Mounted power supplies - one of each type installed.
 6. Selector switches/pushbuttons - Two of each type installed including contact blocks.
 7. Provide touch-up paint, of each type and color used for all cabinets, panels, and consoles supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The panels shall be installed at locations as shown on the Contract Drawings.
- B. Refer to Section 13300.

3.2 TESTS

- A. Refer to Section 13300.

END OF SECTION 13330

SECTION 13340

INSTRUMENTATION AND CONTROLS – INSTRUMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section covers the furnishing, installation, and services for instruments.
- B. Refer to Section 13300.

1.2 RELATED WORK

- A. Refer to Section 13300.
- B. Section 13341 through section 13346, if included.

1.3 SUBMITTALS

- A. Submit complete documentation of all field instruments using ISA-TR20.00.01-2001 (updated in 2004-2006) data sheet formats. Submit a complete Bill of Materials (BOM) or Index that lists all instrumentation equipment. The list shall be sorted by Loop Number.
- B. Submit separate data sheets for each instrument including:
 - 1. Plant Equipment Number and ISA tag number per the drawings
 - 2. Product (item) name used herein and on the Drawings
 - 3. Manufacturer's complete model number
 - 4. Location of the device
 - 5. Input - output characteristics
 - 6. Range, size, and graduations in engineering units.
 - 7. Physical size with dimensions, enclosure NEMA classification and mounting details in sufficient detail to determine compliance with requirements.
 - 8. Materials of construction for enclosure and wetted parts.
 - 9. Instrument or control device sizing calculations where applicable
 - 10. Certified calibration data for all flow metering devices.
 - 11. Two-wire or four-wire device type as applicable.
- C. Submit catalog cuts for all instruments. Submit descriptive literature for each hardware component, which fully describes the units being provided.
- D. Submit index and data sheets in electronic format as well as hard copies on 8-1/2" x 11" formats. Electronic format shall be in Microsoft Excel or Word. Submit electronic copy on CD-ROM or DVD disk.

1.4 MAINTENANCE

- A. Refer to Section 13300.
- B. Test equipment:

1.5 INSTRUMENT TAGS

- A. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as indicated in the Drawings, shall be provided on each piece of equipment supplied under this Section and related sections. Equipment shall be tagged before shipping to the site.
- B. Provide 1/8-in by 3/8-in, Type 316 stainless steel button head machine screws.
- C. All supplied instrument transmitters and instrument transmitter elements shall have a stainless steel identification tag attached to each transmitter and element prior to shipment. Tag shall be attached via stainless steel chain or stainless steel wire (24-gauge min) to a non-removable part of the device. The tag size shall be a minimum of 1.5 square inches. Tag shall include the ISA alphanumeric instrument number as indicated in the P&ID, loop, and detail drawings. The alphanumeric instrument number shall be stamped into the tag and shall have a minimum of 3/16-in high alphanumeric characters.

1.6 OZONE/OXYGEN SERVICE

- A. N/A

1.7 APPROVALS/CERTIFICATIONS

- A. Instruments for hazardous locations shall have Factory Mutual (FM), Canadian Standards Association (CSA), and CENELEC approvals and certifications as specified herein and as indicated on the Drawings or in the Instrument Device Schedule. The instrument specifications in Part 2 state the Class, Division, and gas groups for FM/CSA approval, followed in parenthesis by the CENELEC certification; however, instruments provided are only required to have the approval/certification stated above. The instrument shall have a stainless steel tag identifying the relevant approval or certification.

1.8 MANUFACTURERS' START-UP AND TRAINING SERVICES

- A. If indicated in the individual instrumentation paragraphs, the instrument manufacturer or manufacturer's certified service representative shall provide start-up and training services. This work shall not be done by the PCSS or AESS contractor.
- B. The start-up services shall be to calibrate, oversee the installations of the sensor, and start-up the sensor/transmitter in order to provide reliable measurement at the instrument and

to a remote system. The vendor shall work with the PCSS and AESS to verify the transmitter sends correct information to the remote system (i.e., that the scaling and units are the same at the instrument and on the remote operator interface).

- C. While the instrument manufacturer or manufacturer's certified service representative is starting up the instrumentation, training shall be provided to the Owner's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.

PART 2 - PRODUCTS

2.1 SEE SECTION 13300 FOR LISTING OF INDIVIDUAL INSTRUMENTATION SECTIONS.

2.2 SPARE PARTS AND ACCESSORIES

- A. General requirements for spare parts are specified in section 13300.
- B. The following field Instrument related Spare Parts shall be furnished:
 - 1. One flow indicating transmitter for each type of flow element provided.
 - 2. One level indicating transmitter for each type of level element provided.
 - 3. One temperature transmitter for each type provided.
 - 4. One pressure transmitter for each type provided.
 - 5. One spare ultrasonic level switch for each type provided.
 - 6. One spare float type level switch for each type provided.
 - 7. One spare gas detection system sample pump module for each type provided.
 - 8. Miscellaneous: One-year supply of items recommended by the manufacturer of the equipment including all reagents, pH probes, batteries, chart paper, calibration standards as needed to operate and maintain the furnished equipment.
- C. The following accessories shall be furnished:
 - 1. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.
 - 2. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

PART 3 - EXECUTION

3.1 GENERAL

- A. See execution requirements in Section 13300.
- B. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument

racks or stands. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for calibration, testing and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

END OF SECTION 13340

SECTION 13341

INSTRUMENTATION AND CONTROLS – FLOW DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section covers the furnishing, installation, and services for flow related instruments as detailed on the Drawings.
- B. Refer to Section 13300.

1.2 RELATED WORK

- A. Refer to Section 13300.

1.3 SUBMITTALS

- A. Refer to Sections 13300 and 13340.

1.4 REFERENCE STANDARDS

- A. Refer to Section 13300.

1.5 SYSTEM DESCRIPTION

- A. N/A

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 13300.

1.7 COORDINATION MEETINGS

- A. Refer to Section 13300.

1.8 QUALITY ASSURANCE

- A. Refer to Section 13300.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 13300.

1.10 NOMENCLATURE AND IDENTIFICATION.

- A. Refer to Section 13300.

1.11 MAINTENANCE

- A. Refer to Section 13300.
- B. Test Equipment:

1.12 SPARES AND ACCESSORIES

- A. See Section 13340 for spare parts requirements.
- B. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.
- C. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

1.13 OZONE/OXYGEN SERVICE

- A. N/A

1.14 APPROVALS/CERTIFICATIONS

- A. Instruments specified herein shall meet at a minimum, the National Electrical Manufacturers Association (NEMA) rating for non-hazardous locations listed with each instrument. Those instruments that are submerged in a liquid or are located in submersible area shall also meet NEMA 6 ratings approval. All instruments that are located in hazardous areas as indicated on the Electrical Classification Drawings or in the Instrument Device Schedule shall meet the Factory Mutual (FM), Canadian Standards Association (CSA), and CENELEC Class, Division and Group approvals and certifications listed for that area. The instrument shall have a stainless steel tag identifying the relevant approval or certification

PART 2 - PRODUCTS

2.1 PROPELLER/TURBINE FLOW METER

A. Flow Element

1. Type:
 - a. Magnetically coupled propeller/turbine flowmeter.
2. Function/Performance:
 - a. Accuracy: Plus or minus 2 percent of rate
 - b. Operating Temperature: -20 to 180 degree F.
 - c. Repeatable to +/- 0.25 % of range.
3. Physical:
 - a. Propeller or rotor shall be compatible with process fluid in which it is measuring. The rotor shall be 316 SS, Hast C or molded of polyethylene.
 - b. Propeller shall be secured on shaft with a key.
 - c. For meters in pipes up to 14 inches (350 mm), propeller shafts shall drive the vertical shaft through a magnetic coupling.
 - d. For meters in pipes 16 to 30 inches (400 to 750 mm), the propeller shall be magnetically coupled to the horizontal drive shaft. Gearing on the horizontal and vertical shafts shall be hardened 316 stainless steel.
 - e. Vertical shaft shall have a carbide tip resting on opposing carbide disc.
 - f. Wetted parts shall be coated with a protective coating.
 - g. Meters shall be flange mounted with ANSI 150 lb. flanged ends that shall be compatible and similar to process pipe.
 - h. Meters shall be NEMA 4X (IP65). Where hazardous areas are indicated on the Drawings, the equipment shall be rated for that area.
 - i. Finish: All external surfaces shall have a chemical and corrosion resistant finish.
4. Power Requirements:
 - a. Meter shall receive its power from its transmitter.
5. Accessories/Documentation Required:
 - a. For meters with remote mounted transmitters, signal cable for installation between the meter and the transmitter. Length shall be as required by installation indicated on the Drawings.

B. Flow Totalizer/Transmitter

1. Type:
 - a. Microprocessor based, intelligent transmitter compatible with meter provided.
 - b. Mounted remote from the meter.
2. Functional/Performance:
 - a. Accuracy (including flowtube): Plus/minus 0.5 percent of flowrate.
 - b. Operating Temperature: 14 to 122 degrees F.
 - c. Output: The indicator/totalizer shall provide a 4-20 mA output proportional to flow and a scaled pulsed output for remote totalization. Current output adjustable over the full range of the instrument.

- d. Diagnostics: Self diagnostics with on screen display of faults.
 - e. Display: Digital indicator displaying flow in engineering units indicated in the Instrument Device Schedule.
 - f. Totalizer: A fully configurable totalizer integral to the transmitter. Totalized flow shall be displayed.
3. Physical:
- a. Integral mount suitable for surface or pipe stand mounting. Or mounted remote from the meter as shown on the drawings or as required by the physical location.
 - b. Enclosure shall be NEMA 4X (IP65). Where hazardous areas are indicated on the Drawings, the equipment shall be rated for that area.
4. Power Requirements:
- a. The transmitter shall be a loop powered 24 VDC instrument.
5. Accessories/ Required:
- a. Keypad or remote device where required for transmitter configuration depending upon area classification.
- C. Manufacturer(s):
- 1. McCrometer, Water Specialties ML04
 - 2. Or Approved Equal

PART 3 - EXECUTION

3.1 GENERAL

- A. See execution requirements in Section 13300.

END OF SECTION 13341

SECTION 13343
INSTRUMENTATION AND CONTROLS – PRESSURE DEVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section covers the furnishing, installation, and services for pressure related instruments as detailed on the Drawings.
- B. Refer to Section 13300.

1.02 RELATED WORK

- A. Refer to Section 13300.

1.03 SUBMITTALS

- A. Refer to Sections 13300 and 13340.

1.04 REFERENCE STANDARDS

- A. Refer to Section 13300.

1.05 SYSTEM DESCRIPTION

- A. N/A

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 13300.

1.07 COORDINATION MEETINGS

- A. Refer to Section 13300.

1.08 QUALITY ASSURANCE

- A. Refer to Section 13300.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 13300.

1.10 NOMENCLATURE AND IDENTIFICATION.

- A. Refer to Section 13300.

1.11 MAINTENANCE

- A. Refer to Section 13300.

B. Test Equipment:

1.12 SPARES AND ACCESSORIES

- A. See Section 13340 for spare parts requirements.
- B. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.
- C. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

NOTE: Delete the following paragraph if it is not relevant.

1.13 OZONE/OXYGEN SERVICE

- A. N/A

1.14 APPROVALS/CERTIFICATIONS

- A. Instruments for hazardous locations shall have Factory Mutual (FM), Canadian Standards Association (CSA), and CENELEC approvals and certifications as specified herein and as indicated on the Drawings or in the Instrument Device Schedule. The instrument specifications in Part 2 state the Class, Division, and gas groups for FM/CSA approval, followed in parenthesis by the CENELEC certification; however, instruments provided are only required to have the approval/certification stated above. The instrument shall have a stainless steel tag identifying the relevant approval or certification.

PART 2 PRODUCTS

2.01 DIAPHRAGM SEAL - THREADED

- A. Type:
 - 1. Thread attached.
 - 2. Welded Metal Diaphragm.
- B. Function/Performance:
 - 1. Maximum Pressure: Two times the maximum process pressure.
 - 2. Operating Temperature: -40 to 100 degrees C.
- C. Physical:
 - 1. All 316L stainless steel construction.
 - 2. Teflon gaskets and O rings on process connection.
 - 3. Bleeding connection provided. NOTE: filling screw not recommended since it provides poor quality measurement if done incorrectly in the field.

D. Accessories Required:

1. Stainless steel armored capillary tubing as required for the installation.

E. Manufacturer(s):

1. Rosemount.
2. Ashcroft.
3. Ronningen-Petter Company.
4. Siemens 7MF4861
5. Equal.

2.02 GAUGE PRESSURE OR PRESSURE SENSING LEVEL TRANSMITTERS

A. Type:

1. Microprocessor based, intelligent type.

B. Function/Performance:

1. Range: Range of the transmitter shall be the standard range of the manufacturer closest to the pressure range to be metered.
2. Accuracy: 0.075 percent of span.
3. Operating Temperature: -20 to 80 degrees C.
4. Temperature Effect: Combined temperature effects shall be less than 0.2 percent of maximum span per 28 degrees C temperature change.
5. Output: 4-20 mA DC linear with pressure or level, with HART protocol. Zero adjustable over the range of the instrument provided calibrated span is greater than the minimum calibrated span.
6. Stability: 0.05 percent of upper range limit for 1 year.
7. Display: Digital indicator displaying pressure or level in the engineering units indicated in the Instrument Device Schedule.
8. Diagnostics:
 - a. Self-diagnostics with transmitter failure driving output to above or below out of range limits.
 - b. Simulation capability for inputs and loop outputs.
 - c. Test terminals available to ease connection for test equipment without opening the loop.
 - d. Registers to record minimum and maximum pressure and temperatures transmitter has been exposed to shall be available.

- e. Run-time clock available to determine usage for warranty purposes. 5-year warranty on this clock reading is included.
- 9. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored by the instrument.
- 10. If required to meet the range or suppression/elevation requirements, a differential pressure transmitter shall be provided.

C. Physical:

- 1. Enclosure: NEMA 4X (IP66), explosion proof, approved for Class I, Division 1, Groups C and D (EEx d IIC T5).
- 2. Process Wetted Parts: Isolating diaphragm and other wetted metal parts shall be 316L stainless steel, unless otherwise indicated in the device schedule. Gaskets and O rings shall be Teflon.
- 3. Power Supply: 24 VDC loop power.
- 4. Sensor Fill Fluid: Silicone.

D. Accessories Required:

- 1. Provide span and zero adjustment at each transmitter and through the handheld programming unit.
 - a. Configuration of the transmitter may be accomplished using the local display and pushbuttons without the use of an external programming device.
 - b. NOTE: Siemens, ABB and Foxboro have this capability
- 2. For each transmitter provide a 316 stainless steel block & bleed shut off valve. Valves may be mounted directly to the instrument or separately mounted. Valves shall be by the instrument manufacturer or by D/A Manufacturing or Anderson Greenwood.

E. Manufacturer(s):

- 1. Smar LD301M.
- 2. ABB 264HS.
- 3. Rosemount 3051CG.
- 4. Foxboro IGP20.
- 5. Siemens Sitrans P DS III
- 6. Or equal.

2.03 FLANGE MOUNTED PRESSURE SENSING LEVEL TRANSMITTER

A. Type:

1. Flanged mounted, microprocessor based, intelligent type.

B. Function/Performance:

1. Range: Range of the transmitter shall be the standard range of the manufacturer closest to the pressure range to be metered.
2. Accuracy: 0.075 percent of span.
3. Operating Temperature: -20 to 80 degrees C.
4. Temperature Effect: Combined temperature effects shall be less than 0.2 percent of maximum span per 28 degrees C temperature change
 - a. NOTE: all manufacturers' specifications for remote seal transmitters will have temperature errors above this level.
5. Output: 4-20 mA DC linear with pressure or level with HART protocol. Zero adjustable over the range of the instrument provided calibrated span is greater than the minimum calibrated span.
6. Stability: 0.05 percent of upper range limit for 1 year.
7. Display: Digital indicator displaying level in the engineering units indicated in the Instrument Device Schedule.
8. Diagnostics:
 - a. Self-diagnostics with transmitter failure driving output to above or below out of range limits.
 - b. Simulation capability for inputs and loop outputs.
 - c. Test terminals available to ease connection for test equipment without opening the loop.
 - d. Registers to record minimum and maximum pressure and temperatures transmitter has been exposed to shall be available.
 - e. Run-time clock available to determine usage for warranty purposes. 5-year warranty on this clock reading is included.
9. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored by the instrument.

C. Physical:

1. Enclosure: NEMA 4X (IP66), explosion proof, approved for Class I, Division 1, Groups C and D (Exx d IIC T5).
2. Process Wetted Parts: Isolating diaphragm and other wetted metal parts shall be 316L stainless steel, unless otherwise indicated in the device schedule. Gaskets and O rings shall be Teflon.
3. Flange: Flange shall be ANSI 3-inch, 150 lb. (DN 80, PN 25 or 40) carbon steel.
4. Power supply shall be 24 VDC loop power.

5. Sensor Fill Fluid: Silicone.

D. Accessories Required:

1. Provide span and zero adjustment at each transmitter and through the handheld programming unit.
 - a. Configuration of the transmitter may be accomplished using the local display and pushbuttons without the use of an external programming device.
 - b. NOTE: Siemens, ABB and Foxboro have this capability
2. Provide seals for the flange connection suitable to the process liquid being metered.

E. Manufacturer(s):

1. Smar LD301L.
2. ABB 264Dc
3. Rosemount 3051L.
4. Foxboro IDP10.
5. Siemens Sitrans P DS III
6. Or equal.

2.04 PRESSURE GAUGE

A. Type:

1. Bourdon tube actuated dial face pressure gauge.

B. Function/Performance:

1. Accuracy: Plus or minus 1.0 percent of span or better.

C. Physical:

1. Case: Phenolic shock resistant or type 316 stainless steel for surface/stem mounting with a pressure relieving back. The case shall be vented for temperature/atmospheric compensation. Gauge shall be callable of being liquid filled in the field or at the factory.
2. Window: Clear acrylic or shatter proof glass.
3. Bourdon tube: Stainless steel.
4. Connection: 1/2 in. NPT.
5. Gauge size: Minimum 4-in. viewable.
6. Pointer travel: Not less than 200 degrees not more than 270-degree arc.

7. Range: As indicated in the instrument device schedule. Range may include inches of water vacuum.

D. Accessories/Options Required:

1. Shutoff valve: Each gauge shall have a process shutoff valve that can also be used as an adjustable pressure snubber.
2. Special scales: Engineer reserves the right to require special scales and/or calibration if the manufacturer's standard is not suitable for the application.
3. Gauges listed as liquid filled in the instrument device schedule shall be liquid filled at the factory.

E. Manufacturer(s):

1. Ashcroft.
2. Ametek US Gauge.
3. Weksler.
4. Or equal

PART 3 EXECUTION

3.01 GENERAL

- A. See execution requirements in Section 13300.

END OF SECTION

SECTION 13345

INSTRUMENTATION AND CONTROLS – ANALYTICAL DEVICES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This section covers the furnishing, installation, and services for analytical related instruments as detailed on the Drawings.
- B. Refer to Section 13300.

1.2 RELATED WORK

- A. Refer to Section 13300.

1.3 SUBMITTALS

- A. Refer to Sections 13300 and 13340.

1.4 REFERENCE STANDARDS

- A. Refer to Section 13300.

1.5 SYSTEM DESCRIPTION

- A. N/A

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 13300.

1.7 COORDINATION MEETINGS

- A. Refer to Section 13300.

1.8 QUALITY ASSURANCE

- A. Refer to Section 13300.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 13300.

1.10 NOMENCLATURE AND IDENTIFICATION

- A. Refer to Section 13300.

1.11 MAINTENANCE

- A. Refer to Section 13300.
- B. Test Equipment:

1.12 SPARES AND ACCESSORIES

- A. See Section 13340 for spare part requirements.
- B. All mounting hardware required for pipe stand, surface, or other mounting shall be provided.
- C. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

1.13 OZONE/OXYGEN SERVICE

- A. N/A

1.14 APPROVALS/CERTIFICATIONS

- A. Instruments for hazardous locations shall have Factory Mutual (FM), Canadian Standards Association (CSA), and CENELEC approvals and certifications as specified herein and as indicated on the Drawings or in the Instrument Device Schedule. The instrument specifications in Part 2 state the Class, Division, and gas groups for FM/CSA approval, followed in parenthesis by the CENELEC certification; however, instruments provided are only required to have the approval/certification stated above. The instrument shall have a stainless steel tag identifying the relevant approval or certification.

1.15 MANUFACTURER START-UP AND TRAINING SERVICES

- A. If indicated in the instrumentation paragraphs below, the instrument manufacturer or manufacturer's certified service representative shall provide start-up and training services. This work shall not be done by the PCSS or AESS contractor.
- B. The start-up services shall be to calibrate, oversee the installations of the sensor, and start-up the sensor/transmitter in order to provide reliable measurement at the instrument and to the control system. The vendor shall work with the PCSS and AESS to verify the transmitter sends correct information to the remote system (i.e., that the scaling and units are the same at the instrument and on the remote operator interface). Vendor to submit an instrument calibration report in order to document the calibration procedure of the instruments.
- C. While starting up the analyzers, the manufacturer shall provide training to the Owner's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the analyzer and transmitter.
- D. In addition to the above services, provide a written proposal for a maintenance contract executed by the manufacturer for on-site preventive maintenance services related to the Instrumentation that requires manufacturer services below. The cost of this maintenance contract shall not be included in the Contract Price.

1.16 NETWORKED INSTRUMENTS

- A. Where indicated on the Drawings provide intelligently networked instruments. Provide all components necessary to form a complete and functional instrument network.
- B. Instrumentation communicating via digital pathways (Ethernet TCP/IP, Modbus, Profibus, Profinet, etc.) must be supported by the SCADA/HMI system. The PCSS to provide any additional drivers necessary to establish communication.

PART 2 - PRODUCTS

2.1 SINGLE-PARAMETER UNIVERSAL TRANSMITTER

- A. Type:
 - 1. Microprocessor-based, intelligent transmitter compatible with a minimum of sensor (digital or analog) inputs.
 - 2. Transmitter manufacturer shall be same as instrument sensor where possible.
- B. Function/Performance:
 - 1. Accuracy: $\pm 0.1\%$ of span.
 - 2. Repeatability: $\pm 0.05\%$ of span.

3. Response Time: 60 seconds to 90% of value on a step change.
 4. Temperature Compensation: Compensation over entire temperature range of the instrument.
 5. Environmental Conditions: -10 to 55 °C and 5 to 95% relative humidity.
 6. Outputs:
 - a. Minimum: (2) 4-20mA outputs.
 - b. Minimum: (3) 120VAC, 5A, configurable relays.
 7. Diagnostics: On screen instructions and display of self-diagnostics.
- C. Physical:
1. Transmitter shall be suitable for surface or pipe stand mounting.
 2. Enclosure shall be NEMA 4X (IP65).
 3. Power Requirements: 120VAC powered.
- D. Accessories:
1. Provide sensor connection cable and plug between the transmitter and the analyzer sensor for rapid attachment and exchange of sensor.
 2. Provide connection box for analyzers.
- E. Manufacturer Start-up and Training services:
1. Provide manufacturer's start-up and training services as specified in the start-up and training services paragraph.
- F. Manufacturers:
1. SWAN Analytical USA.
 2. ProMinent Fluid Controls, Inc.
 3. Electro-Chemical Devices
 4. Or Approved equal.

2.2 CHLORINE RESIDUAL ANALYZER

- A. Type:
1. Microprocessor based electronic transmitter/converter a flow through sample cell.
 2. Measures free or total chlorine. Analyzer to be configured or specified for free or total chlorine as indicated on the Drawings or the Instrument Device Schedule.
 3. Utilizes amperometric methods.
- B. Function/Performance:
1. Accuracy: plus or minus 1 percent of full scale or 0.002 mg/l, whichever is greater, below 20 mg/l; ± 5 percent of reading between 20 and 50 mg/l.
 2. Resolution: 0.001 mg/l (<10 mg/l) and 0.01 mg/l (10 to 20 mg/l).
 3. Range: 0-50 mg/l.
 4. Environmental Conditions: The instrument shall operate over an ambient temperature range of 2-50 degrees C.

5. Output: Isolated 4-20 mA output and 3 programmable alarm contacts rated for 5A at 230 VAC.
6. Display: Dot matrix or LCD type displaying chlorine residual in ppm.
7. Temperature Compensation: Compensated for sample temperatures over the temperature range of the instrument.
8. Diagnostics: On screen instructions and self-diagnostics.
9. Response: 90 percent of full scale within 2 minutes.
10. Physical: Analyzers shall be suitable for surface mounting.
11. Power Requirements: 120 VAC/60 Hz.
12. Electronics enclosure shall be NEMA 4X.
13. Sensor shall have three electrodes and shall have an automatic cleaning mechanism.
14. Accessories Required: Provide one year's supply of consumables and one spare electrode.
15. Manufacturer(s):
 - a. SWAN Analytical USA.
 - b. ProMinent Fluid Controls, Inc.
 - c. Electro-Chemical Devices
 - d. Or Approved equal.

C. Manufacturer Start-up and Training services:

1. Provide manufacturer's start-up and training services as specified in the start-up and training services paragraph.

PART 3 - EXECUTION

3.1 GENERAL

- A. See execution requirements in Section 13300.

END OF SECTION 13345

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SECTION 16000

ELECTRICAL - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials and equipment required and install complete and make operational, electrical and process instrumentation systems at the Dade City Orange Valley Water Treatment Facility as shown on the Drawings and as specified herein.
- B. The work shall include furnishing, installing and testing the equipment and materials detailed in the following Sections:
 - 1. 16000 - Electrical - General Provisions
 - 2. 16005 - Electric Motors
 - 3. 16110 - Raceways, Boxes, Fittings and Supports
 - 4. 16120 - Wires and Cables (600 Volt Maximum)
 - 5. 16141 - Wiring Devices
 - 6. 16191 - Miscellaneous Equipment
 - 7. 16285 - Surge Protective Devices
 - 8. 16411 - Disconnect Switches
 - 9. 16412 - Low Voltage Molded Case Circuit Breakers
 - 10. 16440 - Main Circuit Breaker Switchboard
 - 11. 16442 - Group-Mounted Circuit Breakers Switchboard
 - 12. 16491 - Manual Transfer Switches
 - 13. 16500 - Lighting System
 - 14. 16600 - Underground System
 - 15. 16660 - Grounding System
 - 16. 16670 - Lightning Protection
 - 17. 16780 - Reduced Voltage Soft Starters
- C. The work shall include furnishing and installing the following:
 - 1. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions.
 - 2. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions. The Contractor shall install conduit and wire whether shown on the Drawings or not.
 - 3. Conduit, wiring and terminations for transformers, motors and associated equipment, furnished and mounted under other related Divisions.
 - 4. Testing.

- D. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing buildings and structures in which work under this sub-bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has visited the buildings and structures and noted the locations and conditions under which the work will be performed and that he/she takes full responsibility for a complete knowledge of all factors governing his/her work.
- E. Excavation, bedding material, forms, concrete and backfill for underground raceways; forms and concrete for electrical equipment furnished under Division 16. The work shall be in accordance with Divisions 2 and 3.

1.2 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings for equipment, materials and other items furnished under Division 16.
- B. Submit only one manufacturer for each item being submitted. Submittals with multiple manufacturers for a single item will not be reviewed, i.e. three manufacturers for RGS conduit.
- C. Shop drawings shall be submitted for the following equipment:
 - 1. Raceways, Boxes, Fittings and Hangers
 - 2. Wires and Cables
 - 3. Wiring Devices
 - 4. Miscellaneous Equipment
 - 5. Surge Protective Devices
 - 6. Disconnect Switches
 - 7. Low Voltage Molded Case Circuit Breakers, Main Circuit Breaker Switchboards and Group-Mounted Circuit Breaker Switchboards
 - 8. VFD, Motor Starters and Soft Starts
 - 9. Electric Motors
 - 10. Transfer Switches
 - 11. Disconnects
 - 12. Lighting Fixtures and Lamps
 - 13. Lightening Protection
 - 14. Grounding Hardware and Connections
- D. Mark submittals to clearly identify proposed equipment including accessories, options, and features and to exclude parts not applicable to the project.
- E. Check shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform this Section and the Drawings. This statement shall also list all exceptions to this Section and the Drawings. Shop drawings not so checked and noted shall be returned.

- F. The Engineer's check shall be for conformance with the design concept of the project and compliance with this Section and the Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by this Section and the Drawings.
- G. All dimensions shall be field verified at job site and coordinated with the work of all other trades.
- H. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "APPROVED AS NOTED - CONFIRM," "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED."
- I. Operation and Maintenance Data
 - 1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Section 01730. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc, to instruct operating and maintenance personnel unfamiliar with such equipment.
 - 2. Manuals shall include the following as a minimum:
 - a. A comprehensive index.
 - b. A complete "As-Built" set of approved shop drawings.
 - c. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.
 - d. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints.
 - e. System schematic drawings "As-Built," illustrating all components, piping and electric connections of the systems supplied under this Section.
 - f. Detailed service, maintenance and operation instructions for each item supplied.
 - g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
 - h. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
 - i. Complete parts list with stock numbers, including spare parts.

1.3 REFERENCE STANDARDS

- A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:
 - 1. National Electrical Safety Code (NESC)
 - 2. Occupational Safety and Health Administration (OSHA)
 - 3. National Fire Protection Association (NFPA)
 - 4. National Electrical Manufacturers Association (NEMA)
 - 5. American National Standards Institute (ANSI)

6. Insulated Cable Engineers Association (ICEA)
7. Instrument Society of America (ISA)
8. Underwriters Laboratories (UL)
9. Factory Mutual (FM)
10. National Electrical Testing Association (NETA)
11. International Building Code (UBC)
12. Institute of Electrical and Electronics Engineers (IEEE)

- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 PRIORITY OF THE CONTRACT DOCUMENTS

- A. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method, which represents the most stringent option, the highest quality or the largest quantity.
- B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Engineer and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.
- C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.
- D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Engineer.
- E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times.

1.5 ENCLOSURE TYPES

- A. Unless otherwise required, electrical enclosures shall be NEMA Types as follows:

1. NEMA 1 for dry, non-process indoor above grade locations (i.e. administration areas, laboratories, control rooms, electrical rooms).
2. NEMA 12 for “DAMP” locations shown on the Drawings and maintenance shops.
3. NEMA 4X for outdoor locations, rooms below grade (including basements and buried vaults) and “WET” locations, and “CORROSIVE” locations shown on the Drawings.
4. NEMA 7 (and listed for use in the area classifications shown) for “Class I, Div. 1, Group D” and Class I, Div. 2, Group D” hazardous locations shown on the Drawings.

1.6 HAZARDOUS AREAS

- A. Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.
- B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.7 CODES, INSPECTION AND FEES

- A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.
- B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.8 TESTS AND SETTINGS

- A. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements.
- B. Make adjustments to systems and instruct Owner’s personnel in proper operation of the systems.
- C. In addition to the specific testing requirements listed in the individual Sections, the following minimum tests and settings shall be performed.
 1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, motor starters, overload relays, control circuits and equipment for proper operation.
 2. Check the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the Engineer of the same, including MCC cubicle location and driven load designation, motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace same with the correct size overload.

3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.
 4. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.
 5. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.
 6. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation is incorrect for the driven equipment, correct motor connections at the motor terminal box.
 7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.
 8. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed.
 9. Verify all terminations at transformers, equipment, panels and enclosures by producing a 1, 2, 3 rotation on a phase sequenced motor when connected to "A," "B" and "C" phases.
- D. Testing shall be scheduled and coordinated with the Owner and Engineer at least two weeks in advance. Provide qualified test personnel, instruments and test equipment.

1.9 PROTECTIVE DEVICES COORDINATION STUDY

- A. N/A

1.10 INTERPRETATION OF DRAWINGS

- A. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.
- B. Install each three-phase circuit in a separate conduit unless otherwise shown on the Drawings.
- C. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
- D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
- E. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by Engineer and furnish all labor and materials necessary to complete work in an approved manner.

- F. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.
- G. Redesign of electrical or mechanical work, which is required due to the Contractor's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.
- H. Raceways and conductors for low voltage (120 Volts) thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment and the motor starters for a complete and operating system. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats.
- I. Raceways and conductors for the fire alarm are shown on the Drawings. Provide raceways and conductors as required by the system manufacturer for a complete and operating system. Raceways shall be installed concealed in all finished spaces and may be installed exposed or conducted in process spaces.
- J. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete and operating system. Homeruns, as shown on the Drawings, are to assist the Contractor in identifying raceways to be run exposed and raceways to be run concealed. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in all process spaces. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

1.11 PHASE BALANCING

- A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly balanced loads across all phases.
- B. Field balancing of circuits shall not alter the conductor color-coding requirements as specified in Section 16120.

1.12 SIZE OF EQUIPMENT

- A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.
- B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

1.13 RECORD DRAWINGS

- A. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the "Record Drawings."
- B. Record Drawings shall accurately show the installed condition of the following items:
 - 1. One-line Diagram(s).
 - 2. Raceways and pullboxes.
 - 3. Conductor sizes and conduit fills.
 - 4. Panel Schedule(s).
 - 5. Control Wiring Diagram(s).
 - 6. Underground raceway and duct bank routing.
 - 7. Plan view, sizes and locations of distribution transformers, motor control centers and panelboards.
- C. Submit a schedule of control wiring raceways and wire numbers, including the following information:
 - 1. Circuit origin, destination and wire numbers.
 - 2. Field wiring terminal strip names and numbers.
- D. As an alternate, point-to-point connection diagrams showing the same information may be submitted in place of the schedule of control wiring raceways and wire numbers.
- E. Submit the record drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the Engineer.

1.14 EQUIPMENT INTERCONNECTIONS

- A. Review shop drawings of equipment furnished under other related Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.
- B. Furnish and install all equipment interconnections.

1.15 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.
- B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.
- C. Warrant all equipment furnished under Division 16 in accordance with Section 01740. Refer to individual equipment sections for additional warranty items.

1.16 EQUIPMENT IDENTIFICATION

- A. Identify equipment (disconnect switches, separately mounted motor starters, control stations, etc) furnished under Division 16 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.
- B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high black letters on a white background.
- C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SLEEVES AND FORMS FOR OPENINGS

- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.
- B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.
- C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Engineer may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.

- D. Seal all openings, sleeves, penetration and slots as specified in Section 16110.

3.2 CUTTING AND PATCHING

- A. Cutting and patching shall be done in a thoroughly workmanlike manner and be in compliance with modifications and repair to concrete as specified in Section 03740. Sawcut concrete and masonry prior to breaking out sections.
- B. Core drill holes in concrete floors and walls as required.
- C. Install work at such time as to require the minimum amount of cutting and patching.
- D. Do not cut joists, beams, girders, columns or any other structural members.
- E. Cut opening only large enough to allow easy installation of the conduit.
- F. Patching to be of the same kind and quality of material as was removed.
- G. The completed patching work shall restore the surface to its original appearance or better.
- H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.
- I. Remove rubble and excess patching materials from the premises.
- J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.3 INSTALLATION

- A. Any work not installed according to the Drawings and this Section shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.
- B. Electrical equipment shall be protected at all times against mechanical injury or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters. Do not install electrical equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and tested as directed by the Engineer, or shall be replaced at no additional cost at the Engineer's discretion.
- C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.
- D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting requirements Section 09902, at no additional cost to the Owner.

3.4 MANUFACTURER'S SERVICE

- A. Provide manufacturer's services for testing and start-up of the following equipment:
 - 1. VFD 1 day per trip, 1 trip minimum
 - 2. Soft Starts 1 day per trip, 1 trip minimum
- B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturers warranty repairs.

3.5 TRAINING

- A. Provide manufacturer's services for training of plant personnel in operation and maintenance of the equipment furnished under Division 16.
 - 1. VFD 1 day 1 trip minimum
 - 2. Soft Starts 1 day 1 trip minimum
- B. The cost of training programs to be conducted with Owner's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.
- C. Provide detailed O&M manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.
- D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of each system.
- E. All training schedules shall be coordinated with and at the convenience of the Owner. Shift training may be required to correspond to the Owner's working schedule.
- F. Within 120 days of contract award to the Contractor, submit an overview of the proposed training plan. This overview shall include, for each course proposed:
 - 1. An overview of the training plan.
 - 2. Course title and objectives.
 - 3. Prerequisite training and experience of attendees.
 - 4. Recommended types of attendees.
 - 5. Course Content - A topical outline.
 - 6. Course Duration.
 - 7. Course Location - Training center or jobsite.
 - 8. Course Format - Lecture, laboratory demonstration, etc.
 - 9. Schedule of training courses including dates, duration and locations of each class.
 - 10. Resumes of the instructors who will actually implement the plan.
- G. The Engineer will review the training plan submittal with the Owner.

3.6 POWER SYSTEM STUDY

A. N/A

3.7 ELECTRICAL ACCEPTANCE TESTS

A. N/A

END OF SECTION 16000

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SECTION 16005
ELECTRIC MOTORS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Motors, up to 200 Hp, furnished under other Sections, shall be in conformance with the requirements listed in this Section unless otherwise noted.

1.2 RELATED WORK

- A. Division 11 and 15 – Mechanical Equipment

1.3 SUBMITTALS

- A. Submittal of motor data for acceptance shall include complete nameplate data and test characteristics in accordance with NEMA Standard MG1-12.54 “Report of Test Form for Routine Tests on Induction Motors” and, in addition, the following for motors typical of the units furnished:
 - 1. Efficiency at 1/2, 3/4 and full load
 - 2. Power factor at 1/2, 3/4 and full load
 - 3. Motor outline, dimensions and weight
 - 4. Descriptive bulletins, including full description of insulation system
 - 5. Bearing design data
 - 6. Special features (i.e., space heaters, temperature detectors, etc.)
 - 7. Power factor correction capacitor rating and type.

1.4 REFERENCE STANDARDS

- A. Institute of Electrical and Electronics Engineers (IEEE)
- B. National Electrical Manufacturers Association (NEMA)
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 QUALITY ASSURANCE

- A. Routine tests shall be performed on representative motors, and shall include the information described on NEMA MG1-12.54 “Report of Test Form for Routine Tests on

Induction Motors.” Efficiency shall be determined in accordance with IEEE Publication No. 112, Method B. Power factor shall be measured on representative motors.

1.6 SYSTEM DESCRIPTION

- A. Motors specified herein are three phase, squirrel cage induction type for 1/2 Hp and above; single phase for less than 1/2 Hp; or DC motors.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery of motors shall comply with Section 01170.
- B. Storage and handling of motors shall comply with Section 01600.

1.8 PROJECT/SITE REQUIREMENTS

- A. All motors shall be premium efficiency.

1.9 MAINTENANCE

- A. Provide operation and maintenance data in compliance with Section 01730.

1.10 WARRANTY

- A. All motors shall be warranted for a 1-year period, beginning at substantial completion, in compliance with Section 01740, unless otherwise specified in individual sections.

PART 2 - PRODUCTS

2.1 RATING

- A. Each motor shall develop ample torque for its required service throughout its acceleration range at a voltage 10 percent below nameplate rating. Where shown on the Electrical Drawings to be operated on a reduced voltage starter, the motor shall develop ample torque under the conditions imposed by the reduced voltage starting method.
- B. The motor shall not be required to deliver more than its rated nameplate horsepower, at unity (1.0) service factor, under any condition of mechanical or hydraulic loading.
- C. All motors shall be continuous time rated suitable for operation in a 40 degrees C ambient unless noted otherwise.

- D. Specific motor data such as Hp, rpm, enclosure type, etc, is specified under the detailed specification for the equipment with which the motor is supplied.

2.2 ENCLOSURE TYPES

- A. Motors specified herein will conform to one of the following standard enclosure designs:
 - 1. Open Drip Proof
 - 2. Totally Enclosed Fan Cooled (TEFC)
 - 3. Totally Enclosed Non-Ventilated (TENV)
 - 4. Severe Duty
 - 5. Inverter Duty

2.3 NAMEPLATES

- A. The motor manufacturer's nameplates shall be engraved or embossed on stainless steel and fastened to the motor frame with stainless steel screws or drive pins. Nameplates shall indicate clearly all of the items of information enumerated in NEMA Standard MGI-10.38 or MGI-20.60, as applicable.

2.4 CONDENSATION HEATERS

- A. Condensation heaters shall be of the cartridge or flexible wrap around type installed within the motor enclosure adjacent to core iron. Heaters shall be rated for 120 Volt, single phase with wattage as required. The heater wattage and voltage shall be embossed on the motor nameplate. Power leads for heaters shall be brought out at the motor lead junction box.

2.5 WINDING TEMPERATURE DETECTORS

- A. Winding temperature detectors shall be a factory installed, embedded, bi-metallic switch type. This device shall protect the motor against damage from overheating caused by single phasing, overload, high ambient temperature, abnormal voltage, locked rotor, frequent starts or ventilation failure. The switch shall have normally closed contacts. Not less than three detectors shall be furnished with each motor.

2.6 SINGLE PHASE MOTORS

- A. Unless otherwise specified, motors smaller than 1/2 Hp shall be single phase, capacitor start. Small fan motors may be split-phase or shaded pole type if such are standard for the equipment. Wound rotor or commutator-type single-phase motors are not acceptable unless their specific characteristics are necessary for the application.
- B. Motors shall be rated for operation at 115 Volts, single phase, 60 Hz.

- C. Locked rotor current shall not be greater than specified in NEMA Standard MG1-12.32, Design "N."
- D. Motors shall be totally enclosed in conformance with NEMA Standard MG1-10.35. Small fan motors may be open type if suitably protected from moisture, dripping water and lint accumulation.
- E. Motors shall be provided with sealed ball bearings lubricated for 10 years normal use.

2.7 THREE PHASE MOTORS-FRAMES 143T THROUGH 449T

A. General

1. Unless otherwise specified, motors 1/2 Hp and larger shall be 3 Phase, squirrel cage induction type.
2. All motors 3/4 Hp and larger shall be a NEMA frame 143T or larger. 1/2 Hp motors and 3/4 Hp motors rated 1800 and 3600 rpm, shall be a 56 frame. Motors shall be designed and connected for operation on a 480 Volt, 3 Phase, 60-Hz alternating current system. Dual voltage (230/460) rated motors are acceptable.
3. Unless otherwise required by the load, all motors shall be NEMA Design B, normal starting torque. Locked rotor kVA/Hp shall not exceed Code Letter G as described in NEMA Standard MG1-10.37 for motors 20 Hp and larger.
4. Motors connected to variable frequency drives shall be inverter duty rated.
5. Motors shall be by U.S. Electrical Motors, Division of Emerson Electric Co., or approved equal.

B. Bearings

1. Anti-friction motor bearings shall be designed to be re-greasable and initially shall be filled with grease suitable to ambient temperature of 40 degrees C. Bearings shall be AFBMA Types BC or RN, heavy duty, or shall otherwise be shown to be suitable for the intended application in terms of B-10 rating life, Class M3 or better.
2. All grease-lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic type by the Alemite Division of the Stewart-Warner Corporation.

C. Insulation

1. Insulation systems shall be Class B or Class F, operated at Class B temperature rise and shall be manufacturer's premium grade, resistant to attack by moisture, acids, alkalis and mechanical or thermal shock for 480 Volt motors. Provide 80 degree C, Class B rise or better by resistance at 100 percent load and provide a Class F insulation system, suitable for an ambient temperature motor operation of 0 to 40 degree C at no more than 3300 feet above sea level for medium voltage motors. This temperature rise shall be met when motors are operated and controlled with the VFD(s). The motor insulation system shall have full capability to handle the common mode voltage conditions imposed by the VFD.

2. Motors for outdoor service shall have vacuum/pressure impregnated epoxy insulation for moisture resistance.
3. Insulation for inverter duty motor windings shall meet or exceed the Pulse Endurance Index for magnetic wire and shall not be injured when exposed to repeated pulse type waveforms, repetitive high voltage transients, switching frequency and rate of rise of the pulse.

D. Enclosures

1. Motors shall have a steel or cast iron frame and a cast iron or stamped steel conduit box, as specified below. Conduit box shall be split from top to bottom and shall be capable of being rotated to four positions. Synthetic rubber-like gaskets shall be provided between the frame and the conduit box and between the conduit box and its cover. Motor leads shall be sealed with a non-wicking, non-hygroscopic insulating material. A frame-mounted pad with drilled and tapped hole, not less than 1/4-in diameter, shall be provided inside the conduit box for motor frame grounding.
 - a. Totally enclosed fan cooled: TEFC motors shall have a steel or cast iron frame, cast iron end brackets, cast iron conduit box, 1.15 service factor at 40 degrees C, tapped drain holes (corrosion resistant plugs for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger) and upgraded insulation by additional dips and bakes to increase moisture resistance.
 - b. Totally enclosed non-ventilated: TENV motors shall include the same rating and accessories as specified for TEFC motors.
 - c. Severe duty: Motors shall be of the corrosion resistant type conforming to motors designated by the manufacturer as "Corro-Duty," "Mill and Chemical," "Custom Severe Duty," or similar quality designation. Severe duty motors shall have a cast iron frame, cast iron end brackets, cast iron conduit box and 1.15 service factor at [40] degrees C and tapped drain holes (corrosion resistant plug for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger).
 - d. Inverter duty rated: Motors for operation on variable frequency drives shall meet current power quality levels published in NEMA MG1, Part 31 (1993). Consideration shall be given to the primary factors of the variable frequency drive such as the modulation scheme (six-step, PWM, etc), the switching or carrier frequency and the type of power output devices utilized (IGBT etc). Consideration shall also be given to the installation methods such as output cable length, cable installation method, installation of output filters, etc. Enclosures shall be equal to those furnished for severe duty or explosion proof motors. Motor shaft and bearings shall be insulated. Internal service factor shall be 1.15 that of the nameplate. Motors shall be furnished with an internal thermal switch.
 - e. Totally enclosed fan cooled hazardous location: Hazardous location motors shall be approved for Class 1, Division 2, Group D locations with a temperature Code T3B and shall include the same ratings and accessories as specified for TEFC motors.

E. Motor Efficiencies

1. Three phase motors rated 1 Hp and larger shall be of the premium efficiency type. Motors shall have a NEMA Nominal Efficiency not less than the values indicated below. Efficiency values shall be based on tests performed in accordance with IEEE Publication No. 112, Method B. Motors with horsepower or rpm's not listed shall conform to comparable standards of construction and materials as those for listed motors.
2. Where State Energy Codes or Utility Company Energy Rebate Programs dictate higher efficiencies than those listed, the higher efficiency motors shall be furnished.

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Full Load Efficiencies

OPEN MOTORS

Hp	<u>3600 RPM</u>		<u>1800 RPM</u>		<u>1200 RPM</u>		<u>900 RPM</u>	
	<u>Nom.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>	<u>Nom.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>	<u>Nom.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>
1.0	80.0	----	82.5	80.0	80.0	74.0	72.0	68.0
1.5	82.5	77.0	84.0	80.0	84.0	80.0	75.5	72.0
2.0	84.0	80.0	84.0	80.0	86.5	81.5	85.5	82.5
3.0	84.0	80.0	86.5	84.0	86.5	82.5	86.5	84.0
5.0	85.5	82.5	87.5	84.0	88.5	84.0	87.5	85.5
7.5	87.5	82.5	88.5	86.5	89.5	86.5	88.5	86.5
10.0	88.5	85.5	89.5	86.5	90.2	88.5	89.5	87.5
15.0	89.5	87.5	91.0	88.5	91.0	87.5	89.5	87.5
20.0	90.2	88.5	91.0	89.5	91.0	88.5	90.2	88.5
25.0	91.0	89.5	92.4	90.2	91.7	89.5	90.2	88.5
30.0	91.0	89.5	93.0	90.2	92.4	90.2	91.1	89.5
40.0	92.4	90.2	93.0	91.0	93.0	90.2	90.2	88.5
50.0	92.4	90.2	93.0	91.0	93.0	90.2	91.7	90.2
60.0	93.0	91.7	93.6	91.7	93.6	91.0	92.4	91.0
75.0	93.0	91.7	94.1	92.4	93.6	91.7	93.6	92.4
100.0	93.6	91.7	94.1	92.4	94.1	92.4	93.6	92.4
125.0	93.6	91.7	94.5	92.4	94.1	92.4	93.6	92.4
150.0	93.6	92.4	95.0	93.0	94.5	92.4	93.6	92.4
200.0	94.5	92.4	95.0	93.0	94.5	93.0	93.6	92.4

ENCLOSED MOTORS

<u>Hp</u>	3600 RPM		1800 RPM		1200 RPM		900 RPM	
	<u>Nom.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>	<u>Nom.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>	<u>Nom.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>	<u>Nom.</u> <u>Effic.</u>	<u>Min.</u> <u>Effic.</u>
1.0	80.0	-----	82.5	77.0	81.5	72.0	72.0	68.0
1.5	84.0	75.5	84.0	78.5	85.5	80.0	75.5	72.0
2.0	85.5	78.5	84.0	80.0	86.5	80.0	82.5	80.0
3.0	86.5	80.0	88.5	81.5	88.5	81.5	81.5	78.5
5.0	87.5	82.5	88.5	82.5	88.5	82.5	84.0	81.5
7.5	88.5	82.5	91.0	85.5	89.5	85.5	85.5	82.5
10.0	89.5	85.5	91.0	85.5	89.5	85.5	87.5	85.5
15.0	90.2	85.5	91.0	86.5	90.2	87.5	88.5	86.5
20.0	90.2	86.5	91.7	88.5	91.0	87.5	89.5	87.5
25.0	91.0	87.5	92.4	89.5	91.7	88.5	89.5	87.5
30.0	91.0	87.5	93.0	89.5	92.4	89.5	90.2	88.5
40.0	91.7	88.5	93.0	90.2	93.0	90.2	90.2	88.5
50.0	92.4	88.5	93.6	91.0	93.6	90.2	91.0	89.5
60.0	94.1	90.2	94.1	91.7	93.6	90.2	91.7	90.2
75.0	94.1	91.0	94.5	91.7	94.7	91.7	93.0	91.7
100.0	94.1	91.7	95.0	92.4	94.7	91.7	93.0	91.7
125.0	94.5	91.7	95.0	92.4	94.7	91.7	93.6	92.4
150.0	94.5	91.7	95.0	93.0	95.0	93.0	93.6	92.4
200.0	95.0	93.0	95.0	93.6	95.0	93.0	94.1	93.0

Nom. = Nominal
Min. = Minimum
Effic. = Efficiency

END OF SECTION 16005

SECTION 16110

RACEWAYS, BOXES, FITTINGS AND SUPPORTS

GENERAL

1.1 SCOPE OF WORK

- A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

1.2 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, the manufacturers' names and product designation or catalog numbers of all materials specified.

PRODUCTS

1.3 MATERIALS

- A. Rigid Steel Conduit
 - 1. Rigid steel conduit interior and exterior shall be hot-dipped galvanized and be as manufactured by the Allied Tube and Conduit Corp.; Wheatland Tube Co.; Triangle PWC Inc. or approved equal.
- B. Rigid Nonmetallic Conduit
 - 1. PVC conduit shall be rigid polyvinyl chloride schedule 40 as manufactured by Carlon; An Indian Head Co.; Kraloy Products Co., Inc.; Highland Plastics Inc. or approved equal.
- C. Liquidtight Flexible Metal Conduit, Couplings and Fittings
 - 1. Liquidtight flexible metal conduit shall be Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div., Anaconda American Brass Co., American Flexible Conduit Co., Inc.; Universal Metal Hose Co., or approved equal.
 - 2. Fittings used with liquidtight flexible metal conduit shall be of the screw-in type as manufactured by the Thomas & Betts Co., Crouse-Hinds Co. or approved equal.
- D. Flexible Couplings
 - 1. Flexible couplings shall be type ECGJH as manufactured by the Crouse-Hinds Co., Appleton Electric Co., Killark Electric Manufacturing Co., or approved equal.
- E. Boxes and Fittings

1. Pressed steel switch and outlet boxes shall be hot-dipped galvanized as manufactured by the Raco Manufacturing Co.; Adalet Co.; O.Z. Manufacturing Co. or approved equal.
2. For use in NEMA 1 areas, terminal boxes, junction boxes, pull boxes, etc, shall be sheet steel unless otherwise shown on the Drawings. Boxes shall be galvanized and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14-gauge metal and covers shall not be less than 12-gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; Keystone/Rees, Inc. or approved equal.
3. NEMA 4X terminal boxes, junction boxes, pull boxes etc, shall be sheet stainless steel unless otherwise shown on the Drawings. Boxes shall have continuously welded seams and mounting feet. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14-gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; Keystone/Rees, Inc. or approved equal.
4. Cast or malleable iron device boxes shall be Type FD. All cast or malleable iron boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws as manufactured by the Crouse-Hinds Co. or approved equal.
5. Cast aluminum device boxes shall be Type FD. All cast aluminum boxes and fittings shall be copper-free aluminum with cast aluminum covers and stainless steel screws as manufactured by the Killark Electric Co., Crouse-Hinds Co., L. E. Mason Co., or approved equal.
6. Steel elbows and couplings shall be hot-dipped galvanized.
7. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., or approved equal.
8. Conduit wall seals for cored holes shall be Type CSML as manufactured by the O.Z./Gedney Co., or approved equal.
9. Conduit wall and floor seals for sleeved openings shall be Type CSMI as manufactured by the O.Z./Gedney Co., or approved equal.
10. Combination expansion-deflection fittings embedded in concrete shall be Type XD as manufactured by the Crouse-Hinds Co., O.Z./Gedney Co., Spring City Electrical Mfg. Co., or approved equal.
11. Combination expansion-deflection fittings installed exposed shall be Type XJ as manufactured by Crouse-Hinds Co., O.Z. Gedney Co., Spring City Electrical Mfg. Co., or approved equal.
12. Conduit sealing bushings shall be O.Z./Gedney, Type CSB, or approved equal.

F. Conduit Mounting Equipment

1. In dry indoor areas, hangers, rods, backplates, beam clamps, channel, etc, shall be galvanized iron or steel.
 2. Stainless steel channel with stainless steel hardware shall be used in areas designated "WET" and "CORROSIVE" on the Drawings and in outdoor locations. Fiberglass channel shall be resistant to the chemicals present in the area in which it is used.
- G. Conduit Identification Plates
1. Conduit identification plates shall be embossed stainless steel with stainless steel band, permanently secured to the conduit without screws.
 2. Identification plates shall be as manufactured by the Panduit Corp. or approved equal.
- H. Wall and Floor Slab Opening Seals
1. Wall and floor slab openings shall be sealed with "FLAME-SAFE" as manufactured by the Thomas & Betts Corp., Pro Set Systems, Neer Mfg. Co., Specified Technologies, Inc., or approved equal.
- I. Cold Galvanizing Compound
1. Cold galvanizing compound shall be as manufactured by ZRC Products Company, a Division of Norfolk Corp., or approved equal.

EXECUTION

1.4 RACEWAY APPLICATIONS

- A. Except where otherwise shown on the Drawings, or specified, all wiring shall be in rigid steel conduit.
- B. Rigid steel conduit shall be used at all locations (underground and within structures) as raceways for shielded process instrumentation wiring, shielded control wiring, and I/O wiring.
- C. PVC conduit shall be used for concrete encased underground duct banks except as specified in Paragraph 3.01B above and except as specified in Section 16600.
- D. All conduit of a given type shall be the product of one manufacturer.

1.5 BOX APPLICATIONS

- A. Unless otherwise specified herein or shown on the Drawings, all boxes shall be metal.
- B. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

1.6 FITTINGS APPLICATIONS

- A. Conduit wall seals shall be used where underground conduits penetrate walls or at other locations shown on the Drawings.
- B. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather and at other locations shown on the Drawings.

1.7 INSTALLATION

- A. No conduit smaller than 3/4-in electrical trade size shall be used, nor shall any have more than the equivalent of three 90-degree bends in any one run. Pull boxes shall be provided as required or directed.
- B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.
- C. The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction.
- D. Conduit supports, other than for underground raceways, shall be spaced at intervals of 8-ft or less, as required to obtain rigid construction.
- E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-in diameter. Surface mounted panel boxes, junction boxes, conduit, etc, shall be supported by spacers to provide a minimum of 1/2-in clearance between wall and equipment.
- F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.
- G. All conduits on exposed work, within partitions and above suspended ceilings, shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.
- H. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.
- I. Conduit terminating in NEMA 3R, 4, 4X and 12 enclosures shall be terminated with Myers type conduit hubs.
- J. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat-grounding bushings.

- K. Conduits shall be installed using threaded fittings.
- L. Liquidtight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present.
- M. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke.
- N. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.
- O. Expansion fittings shall be used on exposed runs of PVC conduit where required for thermal expansion. Installation and number of fittings shall be as recommended by manufacturer.
- P. All conduit entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer designated area, directly below the vertical section in which the conductors are to be terminated.
- Q. Conduit sealing and drain fittings shall be installed in areas designated as NEMA 7.
- R. A conduit identification plate shall be installed on all power, instrumentation, alarm and control conduits at each end of the run and at intermediate junction boxes, manholes, etc. Conduit plates shall be installed before conductors are pulled into conduits. Exact identification plate location shall be coordinated with the Engineer at the time of installation to provide uniformity of placement and ease of reading. Conduit numbers shall be exactly as shown on the Drawings.
- S. Conduits noted as spare shall be capped or plugged at both ends with easily removable fittings.
- T. Mandrels shall be pulled through all existing conduits that will be reused and through all new conduits 2-in in diameter and larger prior to installing conductors.
- U. 3/16-in polypropylene pull lines shall be installed in all new conduits noted as spares or designated for future equipment.
- V. All conduit that may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits.
- W. Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of NEC Article 370.
- X. Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit shall be furnished and installed.

- Y. Steel channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc, for a rigid installation.
- Z. Conduits shall not cross pipe shafts, access hatches or vent duct openings. They shall be routed to avoid such present or future openings in floor or ceiling construction.
- AA. The use of running threads is prohibited. Where such threads are necessary, a three-piece union shall be used.
- BB. Rigid galvanized steel conduits buried in earth shall be completely painted with bitumastic.
- CC. Rigid galvanized steel conduits, which have been field cut and threaded shall be painted with cold galvanizing compounds.
- DD. Rigid galvanized steel conduit shall be used for elbows and risers at the utility pole for electrical and telephone service conduits.
- EE. Rigid galvanized steel elbows shall be used for pad-mounted transformer stub-ups.

END OF SECTION 16110

SECTION 16120

WIRES AND CABLES (600 VOLT MAXIMUM)

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish, install and test all wire, cable and appurtenances as shown on Drawings and specified herein.
- B. Install I/O cables furnished under Division 13.

1.2 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, samples of proposed wire. Each sample shall have the size, type of insulation and voltage stenciled on the jacket.
- B. Approved wire samples will be sent to the project location for comparison by the Resident Engineer with the wire actually installed.
- C. Installed unapproved wire shall be removed and replaced at no additional cost to the Owner.
- D. Submit only one manufacturer for each wire or cable type.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Carefully handle all conductors to avoid kinks and damage to insulation.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.
- B. All conductors shall be stranded.
- C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

2.2 BUILDING WIRE

- A. Wire for lighting, receptacles and other circuits not exceeding 150 Volts to ground shall be NEC type THHN/THWN as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp., American Insulated Wire Corp., or approved equal.
- B. Wire for circuits over 150 Volts to ground shall be NEC type THHN/THWN for sizes #6 AWG and smaller and shall be NEC type XHHW for sizes #4 AWG and larger as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp., American Insulated Wire Corp., or approved equal.

2.3 CONTROL, STATUS AND ALARM WIRE

- A. Wire shall be No.14 AWG NEC type THHN/THWN, stranded as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp., American Insulated Wire Corp., or approved equal.

2.4 INSTRUMENTATION WIRE

- A. Wire for 4-20 mA, R.T.D., potentiometer and similar signals shall be:
 - 1. Single pair cable:
 - a. Conductors: 2 No. 16 stranded and twisted on 2-in lay
 - b. Insulation: PVC with 300 Volt, 105-degree C rating
 - c. Shield: 100 percent mylar tape with drain wire
 - d. Jacket: PVC with UL and manufacturers identification
 - e. Max overall diameter: 0.262-in
 - f. Misc: UL Subject 13, Type PLTC
 - g. Manufacturers: Belden No. 9316; Manhattan No. M39119

2.5 MOTOR CONNECTIONS

- A. Motor connections serving motors with pigtails and feeders of sizes #4/0 AWG or smaller shall utilize Thomas & Betts series MD or M2D male and female connectors with series MDBOOT or M2DBOOT insulating boots and TY-RAP cable ties. Provide to the Owner (1) crimp tool and (1) die for each wire size.
- B. For all other conditions (Conductors > #4/0), motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and springwasher. Connections shall be insulated with a Raychem Type RVC, roll-on stub insulator or approved equal.

2.6 TERMINATIONS (CONTROL, STATUS AND ALARM CONDUCTORS)

- A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or approved equal.

2.7 TERMINATIONS (INSTRUMENTATION CABLES)

- A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or approved equal.

2.8 WIRE AND CABLE MARKERS

- A. Wire and cable markers shall be “Omni-Grip” as manufactured by the W.H. Brady Co.; Thomas & Betts Co.; 3M Co. or approved equal.
- B. Wire and cables with diameters exceeding the capacity of the “Omni-Grip” shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp. or approved equal.

2.9 WALL AND FLOOR SLAB OPENING SEALS

- A. Wall and floor slab openings shall be sealed with “FLAME-SAFE” as manufactured by the Thomas & Betts Corp. or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end with wire and cable markers.
- B. Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

3.2 WIRE COLOR CODE

- A. All wire shall be color-coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, manholes and other accessible intermediate locations as well as at each termination.
- B. The following coding shall be used:

<u>System</u>	<u>Wire</u>	<u>Color</u>
208Y/120, Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Black
	Phase B	Red
	Phase C	Blue
480Y/277 Volts	Neutral	White
3 Phase, 4 Wire	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow

3.3 TERMINATIONS

- A. Power conductors: Terminations shall be die type or set screw type pressure connectors as specified.
- B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors.
- C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors.

3.4 INSTRUMENTATION CABLES

- A. Instrumentation cables shall be installed in rigid steel raceways as specified. All circuits shall be installed as twisted pairs. In no case shall a circuit be made up using conductors from different pairs.
- B. Terminal blocks shall be provided at all instrument cable junction, and all circuits shall be identified at such junctions.
- C. Shielded instrumentation wire and I/O cables shall be run without splices between instruments, terminal boxes, or panels.
- D. Shields shall be grounded as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.
- E. Seal openings in slabs and walls through which wires and cables pass.

3.5 FIELD TESTING

- A. Test all 600 Volt wire insulation in accordance with the InterNational Electrical Testing Association – 1999 Acceptance Testing Specifications. Submit a written test report of the results to the Engineer. Cables that fail this testing shall be replaced.

END OF SECTION 16120

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SECTION 16141
WIRING DEVICES

GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and install wiring devices as shown on the Drawings and as specified herein.
- B. Provide all interconnecting conduit and branch circuit wiring for receptacle circuits in accordance with the NEC.

1.2 RELATED WORK

- A. Outlet boxes are included in Section 16110.

1.3 SUBMITTALS

- A. Submittals shall be in accordance with in Section 16000.

1.4 REFERENCE STANDARDS

- A. Wiring devices shall comply with the requirements of the National Electric Code (NEC) and shall be Underwriters Laboratories (UL) labeled.

PRODUCTS

1.5 MATERIALS

- A. Wall switches shall be heavy duty, specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be of the following types and manufacturer:
 - 1. Single pole, 20 Amp, 120/277 Volt - Hubbell, Catalog No. CS1221, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 - 2. Double pole, 20 Amp, 120/277 Volt - Hubbell, Catalog No. CS1222, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 - 3. Three way, 20 Amp, 120/277 Volt - Hubbell, Catalog No. CS1223, similar by Cooper; Pass & Seymour, Inc. or approved equal.

4. Four way, 20 Amp, 120/277 Volt - Hubbell, Catalog No. CS1224, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 5. Single pole, 20 Amp, 120/277 Volt - key operated, Hubbell Catalog No. HBL1221L, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 6. Single pole, 20 Amp, 120 Volt - red pilot-lighted handle, Hubbell, Catalog No. HBS1221PL, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 7. Single pole, 20 Amp, 120 Volt, clear lighted handle, Hubbell, Catalog No. HBL1221ILC, similar by Cooper, Inc or approved equal.
 8. Momentary contact, three position, 2 circuit, center off - Hubbell, Catalog No. HBL1557, similar by Cooper; Pass & Seymour, Inc. or approved equal.
- B. Explosion-proof single pole factory sealed switches shall be for 20 Amps, 120/277 volts, mounted in copper free aluminum or malleable iron cast boxes and be similar and equal to Crouse-Hinds EDS Series, similar by Appleton Electric Co.; Killark or approved equal.
- C. Receptacles shall be heavy duty, specification grade of the following types and manufacturer or approved equal. Receptacles shall conform to Fed Spec WC596-F.
1. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Hubbell, Catalog No. CR5362, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 2. Weatherproof/corrosion resistant single, 20 Amp, 125 Volt, 2 Pole, 3 Wire, with cover; Hubbell Catalog No. HBL53CM61 & HBL74CM23WD, similar by Appleton Electric, Crouse-Hinds Co., or approved equal.
 3. Weatherproof/corrosion resistant duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, with cover; Hubbell Catalog No. HBL53CM62 & HBL52CM21, similar by Appleton Electric, Crouse-Hinds Co., or approved equal.
 4. Ground fault interrupter, duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, GFCI feed thru type with "test" and "reset" buttons. Hubbell, Catalog No. GF20L, similar by Cooper; Pass & Seymour, Inc.; or approved equal.
 5. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, transient voltage surge suppressor and audio alarm or indicating light to indicate bad ground or failed MOV. Hubbell, Catalog No. HBL5362SA, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 6. Clock hanger single, 15 Amp, 125 Volt, 2 Pole, 3 Wire, with hanging hook on device plate. Hubbell, Catalog No. HBL5235, similar by Cooper; Pass & Seymour Inc. or approved equal.
 7. Single, "power lock," 20 Amp, 125 Volt, 2 Pole, 3 Wire; Hubbell, Catalog No. HBL23000HG, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 8. Single, 20 Amp, 250 Volt, 2 Pole, 3 Wire; Hubbell, Catalog No. HBL5461, similar by Cooper; Pass & Seymour, Inc. or approved equal.
 9. Single twist-lock, 30 Amp, 125 Volt, 2 Pole, 3 Wire; Hubbell, Catalog No. HBL2610; similar by Cooper; Pass & Seymour, Inc. or approved equal.
 10. Single twist-lock, 20 Amp, 250 Volt, 2 Pole, 3 Wire; Hubbell, Catalog No. HBL2320; similar by Cooper; Pass & Seymour, Inc. or approved equal.
 11. Single twist-lock, 30 Amp, 250 Volt, 2 Pole, 3 Wire; Hubbell, Catalog No. HBL2620; similar by Cooper; Pass & Seymour, Inc. or approved equal.

12. Explosion-proof single, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Hubbell, Catalog No. UGR02031 similar by Appleton Electric, Crouse-Hinds; Harvey Hubbell Inc or approved equal.
13. Explosion-proof duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Appleton Electric, Catalog No. CPC2-2350 and plug, Appleton Electric Catalog No. CPP-2023 similar by Crouse-Hinds; Cooper or approved equal.

D. Device Plates

1. Plates for indoor flush mounted devices shall be of the required number of gangs for the application involved and shall be as follows:
 - a. Administration type buildings: Smooth, high impact nylon of the same manufacturer and color as the device. Final color to be as selected by Architect.
 - b. Where permitted in other areas of the plant, flush mounted devices in cement block construction shall be Type 302 high nickel (18-8) stainless steel of the same manufacturer as the devices.
2. Plates for indoor surface mounted device boxes shall be cast metal of the same material as the box, Crouse-Hinds No. DS23G and DS32G, or approved equal.
3. Oversized plates shall be installed where standard plates do not fully cover the wall opening.
4. Device plates for switches mounted outdoors or indicated as weatherproof shall be gasketed, cast aluminum with provisions for padlocking switches "On" and "Off", Crouse Hinds No. DS185, or approved equal.
5. Multiple surface mounted devices shall be ganged in a single, common box and provided with an adapter, if necessary, to allow mounting of single gang device plates on multi-gang cast boxes.
6. Engraved device plates shall be provided where required.
7. Weatherproof, gasketed cover for GFI receptacle mounted in a FS/FD box shall be Hubbell, Catalog No. WPFS26, similar by Cooper; Pass & Seymour, Inc. or approved equal.

E. Three Phase Power Receptacles

1. Three phase power receptacles and plugs shall be rated for the voltage and current ratings of the connected load unless otherwise shown on the Drawings.
2. Receptacles and plug housings shall be constructed of copper free aluminum listed to UL standard 498 for watertight construction. Hardware shall be stainless steel.
3. Performance
 - a. Maximum working voltage: 600 Volts RMS.
 - b. Dielectric withstands voltage: 3000 Volts.
 - c. Full load break capability at rated current.
 - d. 5000 connect/disconnect cycles at rated voltage and current.
4. Furnish and install one mating plug with each receptacle.
5. Provide the following features:
 - a. Color coded by voltage.
 - b. One piece housing/angled backbox
 - c. Shrouded pins
 - d. Self-closing gasketed cover.

- e. Watertight cable entrances/stress relief grips.
 - f. Mating keys.
- 6. Acceptable manufacturers:
 - a. Hubbell (North American Rated Series II)
 - b. General Electric
 - c. Hubbel
- F. Interlocked Three Phase Power Receptacles
 - 1. Interlocked three-phase power receptacles shall include a combination receptacle and a mechanically interlocked disconnect switch. The two units shall be interlocked to prevent removal or insertion of the plug unless the switch is in the OFF position.
 - 2. Provide a matching plug for every unit furnished.
 - 3. Switch, power receptacle and mating plug shall be constructed of copper free aluminum.
 - 4. Assemble shall be listed to UL Standard 498 for watertight- construction.
 - 5. Hardware shall be stainless steel.
 - 6. Performance:
 - a. Maximum working voltage: 600 Volts RMS.
 - b. Dielectric withstands voltage: 3000 Volts.
 - c. Full load break capability at rated current.
 - d. 5000 connect/disconnect cycles at rated voltage and current.
 - 7. Provide the following features:
 - a. Color coded by voltage.
 - b. One piece housing/angled backbox
 - c. Shrouded pins
 - d. Self-closing gasketed cover.
 - e. Watertight cable entrances/stress relief grips.
 - f. Mating keys.
- G. The disconnect switch shall be unfused with ratings as hereinbefore specified. Provide lockout provisions on the disconnect switch handle.
- H. Acceptable manufacturers:
 - 1. Crouse-Hinds
 - 2. Appleton
 - 3. Killark
 - 4. Hubbell

EXECUTION

1.6 INSTALLATION

- A. Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypsum board construction, in dry areas with cement block construction or when raceways are shown as concealed on the Drawings.

- B. Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE on the Drawings. Provide surface mounted devices in these areas.
- C. Provide weatherproof device covers in areas designated WET or WET/CORROSIVE on the Drawings.
- D. Convenience outlets shall be 12-in above the floor unless otherwise required.
- E. Convenience outlets installed outdoors and in rooms where equipment may be hosed down shall be 18-in above floor or grade.
- F. The location of all devices is shown, in general, on the Drawings and may be varied within reasonable limits so as to avoid any piping or other obstruction without extra cost, subject to approval of the Owner. Coordinate installation of the devices for piping and equipment clearance.

END OF SECTION 16141

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SECTION 16191
MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish and install all miscellaneous equipment as shown on the Drawings and as specified herein.

1.2 EQUIPMENT LIST

- A. This Section provides the requirements for miscellaneous equipment typically employed in a facility, however, not all components specified in this Section are necessarily utilized on this project.

1.3 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified.

1.4 REFERENCE STANDARDS

- A. Equipment enclosures shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

PART 2 - PRODUCTS

2.1 GENERAL

- A. NEMA 4X enclosures shall be stainless steel.
- B. NEMA 7 enclosures shall be copper free cast aluminum.

2.2 MATERIALS

- A. Disconnect Switches
 1. Disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle.

2. Switches shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or approved equal.
- B. Manual Motor Starters
1. Manual starters shall be suitable for the voltage and number of phase shown on the Drawings and shall be non-reversing, reversing or two speed type as shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. Manual starters shall have motor overload protection in each phase.
 2. Manual motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or approved equal.
- C. Magnetic Motor Starters
1. Motor starters shall be 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. Minimum size shall be NEMA size 1.
 2. Two speed starters shall be for single or two winding motors as shown on the Drawings.
 3. Each motor starter shall have a 120 Volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.
 4. Motor overload protection: Ambient compensated, adjustable, 3-Pole, thermal bi-metallic or melting alloy-type, with push-to-test feature. Overload relays for submersible pump motors shall be ambient compensated, quick trip, Class 10. Overload relays shall be manually reset from the outside enclosure by means of an insulated pushbutton. Provide auxiliary alarm contacts where shown on the Drawings.
 5. Control power transformers shall be sized for additional load where required. Transformer primaries and secondaries shall be equipped with time-delay fuses.
 6. Built-in control stations and indicating lights shall be furnished with custom schematics where shown on the Drawings.
 7. Magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer or approved equal.
- D. Combination Magnetic Motor Starters
1. Motor starters shall be a combination motor circuit protector and contactor, 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing unless otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings. Minimum size shall be NEMA size 1. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be current limiting type, with additional current limiters if required. Combination motor starters shall be fully rated for 22,000 Amps RMS symmetrical.

2. Two speed starters shall be for single or two winding motors as shown on the Drawings.
3. Each motor starter shall have a 120 Volt operating coil and control power transformer. Transformer primaries and secondaries shall be equipped with time-delay fuses. Three-phase starters shall have three overload relays. One normally open and one normally closed auxiliary contact shall be provided as spares in addition to contacts shown on the Drawings.
4. Motor overload protection: Ambient compensated, adjustable, 3-Pole, thermal bi-metallic or melting alloy-type, with push-to-test feature. Overload relays for submersible pump motors shall be ambient compensated, quick trip, Class 10. Overload relays shall be manually reset from the outside enclosure by means of an insulated pushbutton. Provide auxiliary alarm contacts where shown on the Drawings.
5. Furnish built-in control stations and indicating lights where shown on the Drawings.
6. Combination magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or approved equal.

E. Unit Heater Combination Contactors

1. Combination contactors shall be a fused switch and contactor, 600 Volt, 3 Pole, 60 Hz, magnetically operated. NEMA size shall be as required for the kilowatt ratings shown on the Drawings, but shall be not less than NEMA size 1.
2. Contactors shall have a 120 Volt operating coil and control power transformer. Furnish the control power transformer with extra capacity for the unit heater fan.
3. Combination contactors shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or approved equal.

F. Control Stations

1. Control stations shall be heavy-duty type, with full size operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.
2. Control stations shall be Square D Class 9001, similar by Cutler-Hammer; General Electric Co., or approved equal.

G. General Purpose Dry Type Transformers

1. Transformers shall be dry type, two-winding with kVA and voltage ratings as shown on the Drawings. Transformer shall incorporate a 220 degree C insulation system and be designed not to exceed 115 degrees C temperature rise above a 40 degree C ambient full load
2. Four full capacity taps shall be furnished, two 2-1/2 percent above and two 2-1/2 percent below rated primary voltage.
3. Windings shall be copper.
4. Transformers shall be built in accordance with ANSI C89.2 and NEMA ST-20, shall be UL listed and suitable for non-sinusoidal current loads with a K-factor of 4.
5. Transformers shall be furnished with mounting hardware.

6. Transformers shall have common core construction with low hysteresis and eddy current losses. The core flux density shall be below the saturation point to prevent overheating caused by harmonic distortion.
 7. Transformer impedance shall be a minimum of 3 percent and a maximum of 5 percent.
 8. The neutral bus shall be sized and configured for 200 percent of secondary full load current.
 9. Transformers shall be manufactured by Sorgel; General Electric Co.; Cutler-Hammer, Square D, Siemens, or approved equal.
- H. Transient Voltage Surge Suppressors (TVSS) – Service Entrance Suppressors
1. Surge Protective Device Description: Modular design with field-replaceable modules and the following features and accessories:
 - a. Fuses, rated at 200-kA interrupting capacity.
 - b. Equipment Interrupting Rating: Equal to the equipment in which it is installed.
 - c. Fabrication using bolted compression lugs for internal wiring.
 - d. Redundant suppression circuits.
 - e. Replaceable modules.
 - f. Arrangement with copper busbars and for bolted connections to phase buses, neutral bus, and ground bus.
 - g. Red and green LED indicator lights for power and protection status.
 - h. Audible alarm, with silencing switch, to indicate when protection has failed.
 - i. One set of dry contacts rated at 5 a and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 - j. Surge-event operations counter.
 2. Peak Single-Impulse Surge Current Rating: 240 kA per phase
 3. Connection Means: Permanently wired
 4. Protection modes and UL 1449 clamping voltage for grounded wye circuits with voltages of 480Y/277; 3-phase, 4-wire circuits, shall be as follows:
 - a. Line to Neutral: 800 V for 480Y/277
 - b. Line to Ground: 800 V for 480Y/277
 - c. Neutral to Ground: 800 V for 480Y/277
 5. TVSS shall be manufactured by United Power Corporation, Liebert, Advanced Protection Technologies, Lea International, Square D, Eaton-Cutler-Hammer, General Electric or Siemens.
- I. Lightning Arrester and Surge Capacitor
1. Lightning arrester shall be 650 Volt, 3 Phase, “Tranquell” type; General Electric Co., Catalog No. 9L15ECC001; Square D Co., No. J9200; Cutler-Hammer, Type MW, or approved equal.
 2. Surge Capacitor shall be 650 Volt, 3 Phase, non-toxic liquid insulated, General Electric Co., Catalog No. 9L18BAB301; Square D Co.; Cutler-Hammer, or approved equal.

J. Wireway

1. NEMA 1 wireway shall be painted steel with screw covers.
 2. NEMA 4 and 4X wireway shall be stainless steel with gasketed screw covers and stainless steel screws.
 3. NEMA 1 wireway shall be Square-Duct as manufactured by the Square D Co.; NEMA 4 and 4X shall be Bulletin F-22 as manufactured by the Hoffman Engineering Co.; Appleton; Killark, or approved equal.
- K. Control Relays
1. Control relays shall have 10 Amp, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. Latching relays shall be General Electric Co., Catalog No. CR120BL; similar by Square D Co.; Allen-Bradley Co., or approved equal.
 2. Time delay relays shall be pneumatic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as shown on the Drawings. Relays shall be Agastat Model 7012 or 7022; similar by Square D Co.; Cutler-Hammer, or approved equal.
- L. Polyethylene Warning Tape
1. Warning tape shall be red polyethylene film, 6-in minimum width.
 2. Warning tape shall be W.H. Brady Co., Catalog No. 91296; Seaton; Klein Tools; T&B, or approved equal.
- M. Terminal Blocks
1. Terminal blocks shall be NEMA type rated at 20 amperes minimum, 600 Volt, channel mounted, with tubular screw and pressure plate.
 2. Terminal blocks shall be Bulletin 1492 as manufactured by the Allen-Bradley Co.; ABB; Kukla, or approved equal.
- N. 30 Amp, 480-Volt Receptacles
1. 30 Amp, 480 Volt receptacles shall be 3 Pole, 4 Wire, grounding pin-and-sleeve type, with circuit breaking capability.
 2. 30 Amp, 480 Volt receptacles shall be Crouse-Hinds, Arktite style 2, Catalog No. ARE 3423 or approved equal.
 3. Furnish and install one matching plug for each receptacle shown on the Drawings.
- O. JIC Boxes for GF Receptacles
1. JIC boxes shall be 6-in by 6-in by 4-in aluminum continuous hinge clamp cover boxes, Hoffman, Catalog No. A-606 CHAL with Type L23 stainless steel fast operating JIC clamp or approved equal.
 2. Install 1-1/2-in bushings in bottom of box for cord and plug to pass through.
- P. Corrosion Inhibitors
1. All equipment enclosures, terminal boxes, etc, located in a corrosive rated area (where shown on the Drawings) that contains electrical or electronic equipment or terminal strips shall be furnished with an internally mounted, chemically treated corrosion inhibitor pad.

2. The corrosion inhibitor pads shall be as manufactured by Hoffman Engineering Co.; 3M or approved equal.

Q. Equipment Identification Nameplates

1. All field mounted electrical equipment such as disconnects, push button stations, etc, shall be provided with a weather resistant engraved laminoid equipment identification nameplate screwed or bolted adjacent to the device. Nameplate shall identify the mechanical equipment controlled exactly as shown on the electrical singleline drawings (i.e., P-95 Cooling Water Pump No. 1).

R. Equipment Mounting Stands

1. Equipment mounting stands shall be custom fabricated from 1/4-in steel plate and 4-in steel channel, as shown on the Drawings.
2. Hot dip galvanizing shall conform to the requirements of Division 5.
3. Provide mounting equipment per Section 16110.

S. Lighting Contactor

1. Lighting contactor shall be of the electrically operated, mechanically held type mounted in NEMA 1, enclosures (except where noted otherwise on the Drawings) with number of poles as noted on the Drawings. Operating coils shall be rated for 120 Volts unless otherwise indicated on the Drawings and shall be for momentary operation. Provide with "Hand Off-Auto" switch on cover where shown on the Drawings.
2. Contactors shall be rated for 30 Amps (or as shown on the Drawings), 600 VAC and shall be Automatic Switch Co., Bulletin 917 RC, similar by Square D Co.; Cutler-Hammer, or approved equal.

T. Medium Voltage Splicing System

1. N/A

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting Stands

1. Field mounted disconnects, pushbutton control stations, etc, shall be mounted on steel stands as shown on the Drawings. Where clearance requirements for stands may not be maintained, the Engineer may direct equipment to be wall-mounted adjacent to the drive, but in no case shall the distance from the drive motor to the control station exceed 3-ft.

END OF SECTION 16191

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SECTION 16411
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Fusible and non-fusible disconnect switches.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Commissioning.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16075 - Identification for Electrical Systems.

1.2 REFERENCES

- A. As specified in Section 16050.
- B. Underwriters Laboratories Inc. (UL):
 - 1. 20 - General-Use Snap Switches.
 - 2. 98 - Enclosed and Dead-Front Switches.
 - 3. 508 - Standard for Industrial Control Equipment.
- C. National Electric Manufacturer's Association (NEMA):
 - 1. 250 - Enclosures for Electrical Equipment.
 - 2. KS 1-2001- Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

1.3 DEFINITIONS

- A. As specified in Section 16050.
- B. Specific definitions:
 - 1. Safety switches and disconnect switches are to be considered synonymous.

1.4 SYSTEM DESCRIPTION

- A. Provide heavy-duty type disconnect switches as indicated on the Drawings and specified in the Contract Documents.

- B. Provide disconnect switches with the number of poles, voltage, current, short circuit, and horsepower ratings as required by the load and the power system.
- C. Provide a local horsepower rated disconnect switch as indicated on the Drawings.

1.5 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 - 1. Manufacturer.
 - 2. Manufacturer's specifications and description.
 - 3. Ratings:
 - a. Voltage.
 - b. Current.
 - c. Horsepower.
 - d. Short circuit rating.
 - 4. Fused or non-fused.
 - 5. NEMA enclosure type.
 - 6. Dimensions:
 - a. Height.
 - b. Width.
 - c. Depth.
 - 7. Weight.
 - 8. Cross-referenced to the disconnect schedule indicated on the Drawings.
- C. Shop drawings:
 - 1. Manufacturer's installation instructions:
 - a. Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance, Regulatory Requirements below.
 - b. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
 - 2. Identify motor or equipment served by each switch; indicate nameplate inscription.
- D. Installation instructions:
 - 1. Provide anchorage instructions and requirement based on the seismic requirements at the Project Site as specified in Section 16050 and calculations:
 - a. Stamped by a professional engineer registered in the state where the Project is being constructed.

1.6 QUALITY ASSURANCE

- A. As specified in Section 16050.

- B. Regulatory requirements:
 - 1. NEMA KS1- Enclosed and Miscellaneous Distribution Switches (600 V Maximum).
 - 2. UL 98 - Enclosed and Dead-Front Switches.
- C. Disconnect switches shall be UL listed and labeled.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.8 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.9 SEQUENCING

- A. Conduct the initial fault current study as specified in Section 16305 and submit results for Engineer's review.
- B. After successful review of the initial fault current study, submit complete equipment submittal.

1.10 WARRANTY

- A. As specified in Section 16050.

1.11 SYSTEM START-UP

- A. As specified in Section 16050.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. One of the following or equal:
 - 1. Schneider Electric/Square D Company.
 - 2. Eaton/Cutler-Hammer.
 - 3. General Electric.
 - 4. Siemens.
 - 5. Appleton.
 - 6. Crouse-Hinds.

2.2 EQUIPMENT

A. Switch mechanism:

1. Quick-make, quick-break heavy-duty operating mechanisms:
 - a. Provisions for padlocking the switch in the Off position.
 - b. A minimum of 90-degree handle travel position between Off and On positions:
 - 1) Provide handle position indicators to identify the handle position.
 - c. Full cover interlock to prevent opening of the switch door in the On position and to prevent closing the switch mechanism with the door open:
 - 1) With an externally operated override.

B. Switch interior:

1. Switch blades visible when the switch is Off and the cover is open.
2. Lugs:
 - a. Front accessible.
 - b. Removable.
 - c. UL listed for 60/75-degree Celsius copper conductors.
3. Current carrying parts completely plated to resist corrosion.
4. Removable arc suppressors to facilitate easy access to line side lugs.
5. Furnish equipment ground kits for every switch.

C. Fused switches:

1. Furnish with fuses as indicated on the Drawings:
 - a. Provide fuses as specified in Section 16494.
2. UL approved for field conversion from standard Class H fuse spacing to Class J fuse spacing:
 - a. Ratings 100 amperes through 600 amperes at 240 volts.
 - b. Ratings 30 amperes through 600 amperes at 600 volts.
 - c. Provide spring reinforced and plated fuse clips.

D. Ratings:

1. UL horsepower rated for AC or DC with the rating not less than the load served.
2. Current:
 - a. 30 to 1,200 amperes.
3. Voltage:
 - a. 250 volts AC, DC.
 - b. 600 volts (30 A to 200 A, 600 volts DC).
4. Poles:
 - a. 2, 3, 4, and 6 poles.
5. UL listed short circuit ratings:
 - a. 10,000 RMS symmetrical amperes when used with or protected by Class H or K fuses (30-600 amperes).
 - b. 200,000 RMS symmetrical amperes when used with or protected by Class R or J fuses (30-600 amperes employing appropriate fuse rejection).

- c. 200,000 RMS symmetrical amperes when used with or protected by Class L fuses (800-1,200 amperes).
- 6. Where not indicated on the Drawings, provide switches with the NEMA ratings specified in Section 16050 for the installed location.
- E. Size, fusing and number poles as indicated on the Drawings or as required:
 - 1. Provide solid neutral where indicated on the Drawings.
- F. Provide heavy duty pre-wired receptacle disconnect switches for 3-phase, 3-wire, grounded type plugs. Interlock receptacle disconnect switch handle mechanisms so that power plugs may not be inserted or removed when switch is in the On position:
 - 1. 30 to 100 amp fusible, non-fusible, or with circuit breaker as indicated on the Drawings.

2.3 ACCESSORIES

- A. Disconnect switches to have provisions for a field installable “B” type electrical interlock for position indication as indicated on the Drawings.
- B. Disconnect switches to have provisions for a field installed insulated groundable neutral kit as indicated on the Drawings.
- C. NEMA Type 7 and 9 enclosures furnished with drain and breather kit when used in outdoor applications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. As specified in Section 16050.
- B. Install the equipment in accordance with the accepted installation instructions and anchorage details to meet the seismic and wind load requirements at the Project site.
- C. General:
 - 1. Use Myers hubs or bolt-on hubs for all conduit penetrations on NEMA Type 12, Type 4, and Type 4X enclosures.
 - 2. Provide all mounting brackets, stands, supports and hardware as required:
 - a. Match finish and materials for all brackets, stands, and hardware with the switch installed.
 - b. Provide adequate supporting pillar(s) for disconnect switches in accordance with the approved seismic calculations, and locate aboveground or above decks, where there is no structural wall or surface for box.
 - 3. When possible, mount switches rigidly to exposed building structure or equipment structural members:

- a. For NEMA Type 4 and Type 4X locations, maintain a minimum of 7/8 inch air space between the enclosure and supporting surface.
 - b. When mounting on preformed channel, position channel vertically so that water may freely run behind the enclosure.
- 4. Provide a nameplate for each disconnect switch:
 - a. Provide per requirements specified in Section 16075.
 - b. Identify voltage, circuit, fuse size, and equipment served on the nameplate.

3.2 COMMISSIONING

- A. As specified in Section 01756.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.4 CLEANING

- A. As specified in Section 16050.

3.5 PROTECTION

- A. As specified in Section 16050.

END OF SECTION

SECTION 16412

LOW VOLTAGE MOLDED CASE CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Low voltage molded case circuit breakers.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Commissioning.
 - 3. Section 16050 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 16050.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. AB 3. - Molded Case Circuit Breakers and Their Application.
- C. Underwriter's Laboratories (UL):
 - 1. 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - 2. 943 - Ground Fault Circuit Interrupters.

1.3 DEFINITIONS

- A. As specified in Section 16050.
- B. In accordance with UL 489.

1.4 SYSTEM DESCRIPTION

- A. Molded case thermal magnetic or motor circuit protector type circuit breakers as indicated on the Drawings and connected to form a completed system.

1.5 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.

- B. Product data:
 - 1. Catalog cut sheets.
 - 2. Manufacturer's time-current curves for all molded case circuit breakers furnished.

1.6 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. Low voltage molded case circuit breakers shall be UL listed and labeled.

1.7 DELIVERY, STORAGE AND HANDLING

- A. As specified in Section 16050.

1.8 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.9 WARRANTY

- A. As specified in Section 16050.

1.10 SYSTEM START-UP

- A. As specified in Section 16050.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. One of the following or equal:
 - 1. Eaton/Cutler-Hammer.
 - 2. General Electric Company.
 - 3. Schneider Electric/Square D Company.
 - 4. ABB.

2.2 MANUFACTURED UNITS

- A. General:
 - 1. Conforming to UL 489.
 - 2. Operating mechanism:
 - a. Quick-make, quick-break, non-welding silver alloy contacts.

- b. Common Trip, Open and Close for multi-pole breakers such that all poles open and close simultaneously.
 - c. Mechanically trip free from the handle.
 - d. Trip indicating handle - automatically assumes a position midway between the manual ON and OFF positions to clearly indicate the circuit breaker has tripped.
 - e. Lockable in the "OFF" position.
 - 3. Arc extinction:
 - a. In arc chutes.
 - 4. Voltage and current ratings:
 - a. Minimum ratings as indicated on the Drawings.
 - b. Minimum frame size 100A.
 - 5. Interrupting ratings:
 - a. Minimum ratings as indicated on the Drawings.
 - b. Modify as required to meet requirements of the short circuit fault analysis - as specified in Section 16305.
 - c. Not less than the rating of the assembly (panelboard, switchboard, motor control center, etc.)
- B. Motor circuit protectors:
- 1. Instantaneous only circuit breaker as part of a listed combination motor controller.
 - 2. Each pole continuously adjustable in a linear scale with 'LO' and 'HI' settings factory calibrated.

2.3 COMPONENTS

- A. Terminals:
- 1. Line and load terminals suitable for the conductor type, size, and number of conductors in accordance with UL 489.
- B. Case:
- 1. Molded polyester glass reinforced.
 - 2. Ratings clearly marked.
- C. Trip units:
- 1. Provide thermal magnetic or solid-state trip units as indicated on the Drawings.
 - 2. Thermal magnetic:
 - a. Instantaneous short circuit protection.
 - b. Inverse time delay overload.
 - c. Ambient or enclosure compensated by means of a bimetallic element.
 - 3. Solid state:
 - a. With the following settings as indicated on the Drawings.
 - 1) Adjustable long-time current setting.
 - 2) Adjustable long-time delay.
 - 3) Adjustable short time pickup.
 - 4) Adjustable short time delay.

- 5) Adjustable instantaneous pickup.
- 6) Adjustable ground fault pickup as indicated on the Drawings.
- 7) Adjustable ground fault delay as indicated on the Drawings.

D. Provide ground fault trip devices as indicated on the Drawings.

E. Molded case circuit breakers for use in panelboards:

1. Bolt-on type.
 - a. Plug-in type breakers are not acceptable.
2. Ground fault trip devices as indicated on the Drawings.

2.4 ACCESSORIES

A. Shunt trip:

1. Provide a trip coil to remotely open breaker as indicated on the Drawings.

B. Undervoltage trip:

1. Electrically trips breaker when control circuit voltage falls to a preset voltage as indicated on the Drawings.

C. Auxiliary switches:

1. Provide open/closed status switches for remote monitoring of breaker as indicated on the Drawings.

D. Alarm switches:

1. Provide normally open contact that is actuated when breaker trips as indicated on the Drawings.

E. Lockable handle:

1. Provide assembly to lock operating handle in 'OPEN' position.
2. Where a molded case circuit breaker is located in a dedicated enclosure, provide a lockable handle. Reference the Electrical Specifications for additional locking requirements associated with other mounting installations.

F. Key interlocks:

1. Provide key operated interlocks to ensure safe switching procedures as indicated on the Drawings.

G. Electrical motorized operator:

1. Provide motorized breaker operator as indicated on the Drawings.

2.5 SOURCE QUALITY CONTROL

A. Test breakers in accordance with:

1. UL 489.
2. Manufacturer's standard testing procedures.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install breakers to correspond to the accepted shop drawings.

3.2 COMMISSIONING

- A. As specified in Section 01756.

3.3 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.4 ADJUSTING

- A. Adjust trip settings in accordance with Protective Device Coordination Study as accepted by the Engineer and in accordance with manufacturer's recommendations.
- B. Adjust motor circuit protectors in accordance with NEC and the manufacturer's recommendation based on the nameplate values of the installed motor.

3.5 PROTECTION

- A. As specified in Section 16050.

END OF SECTION

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SECTION 16440

MAIN CIRCUIT BREAKER SWITCHBOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Requirements for new service entrance rated main circuit breaker with free standing, front accessible, dead-front type metal-enclosed switchboard cabinet.
- B. Related sections:
 - 1. Section 01140 – Work Restrictions
 - 2. Section 16050 – Common Work Results for Electrical
 - 3. Section 16305 – Electrical System Studies

1.2 REFERENCES

- A. National Electrical Manufacturers' Association (NEMA):
 - 1. PB-2 - Dead-front Distribution Switchboards.
- B. Underwriters' Laboratories, Inc. (UL):
 - 1. 50 - Standard for Enclosures for Electrical Equipment.
 - 2. 891 - Switchboards.

1.3 SUBMITTALS

- A. Product data:
 - 1. Switchboard dimensions and weight
 - a. Height.
 - b. Length.
 - c. Width.
 - 2. Nameplate schedule and Warning Safety Signs
 - 3. Bill of material.
 - 4. Switchboard Ratings:
 - a. Voltage, Phase, Current, Interrupting Rating, Momentary Current Rating
 - 5. Main Circuit Breaker and Electronic Trip Unit Data:
 - a. Voltage, Phase, Current, Interrupting Rating, Momentary Current Rating
 - b. Electronic Trip Unit Protective Features.
 - c. Power Supply for Electronic Trip Unit
 - d. Control Selector Switch for “RELT-Reset-Normal Mode.”
 - e. Auxiliary Power Supply for RELT Module

- f. Instructions for Protective Settings
 - 6. Voltage Transient Surge Protector:
 - a. Protective Modes and Features
 - b. Indicating Status LEDs
 - c. Protective Current Limiting Circuit Breaker for Surge Protector
- B. Shop drawings:
 - 1. Layout drawings, hinged door, front interior panel, bottom conduit window.
 - 2. Terminal lugs for input and output cables.
 - 3. Grounding lug
- C. Installation instructions:
 - 1. Provide anchorage instructions and requirements for the cabinet.
- D. Operating and maintenance manuals:
 - 1. Submit operating instructions and a maintenance manual for the circuit breaker and surge protective device
- E. Test reports: Provide a test report according to specifications section 16950

1.4 PROJECT OR SITE CONDITIONS

- A. The existing source of available short circuit current from the utility service transformer is unknown at the time of design. The existing utility power transformer does not have protective device on the transformer output; therefore the category of arc flash on the line side of the main circuit breaker is anticipated that it will be category 3 or higher, as a result there may not be available PPE equipment for personnel, to service and/or troubleshoot the equipment electrical conditions without electric hazard, when equipment is energized with removed protective cover panels and life parts.
- B. Work within electrical service entrance equipment and with exposed energized parts shall not be done, unless the utility service power is shutdown.
- C. The front panel of the service entrance switchboard cabinet shall include warning labels, indicating that circuit breaker cover panels shall not be removed with energized circuit breaker.

1.5 PROJECT SCHEDULE

- A. Provide equipment according with project schedule and requirements for expedite manufacturing and delivery of the switchboard,

1.6 WARRANTY

- A. Provide a one-year warranty on products and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Breaker Enclosure, One of the following:
 - 1. Eaton/Cutler-Hammer, "Pow-R-Line C."
 - 2. Schneider Electric/Square D. "Power-Style QED."
 - 3. General Electric "Spectra Series".
- B. Circuit Breaker, Molded Case; One of the following:
 - 1. Eaton/Cutler-Hammer, "Electronic RMS – R Frame"
 - 2. Schneider Electric/Square D. "Masterpact NW"
 - 3. General Electric, Power Break II.
- C. Circuit Breaker, Electronic Trip Unit; One of the following:
 - 1. Eaton/Cutler-Hammer, "Digitrip RMS-310 plus (+), with additional Maintenance Selector Switch for Reduce Arc Flash Incident Energy"
 - 2. Schneider Electric/Square D. "Electronic Trip – Micrologic, with additional Alternate Maintenance Setting (AMS) Switch (for Reduce Arc Flash Incident Energy)".
 - 3. General Electric, "Intelliguard Trip Unit," with additional Alternate Maintenance Setting (AMS) Switch (for Reduced Energy Let Through (RELT)).

2.2 EQUIPMENT.

- A. Factory assembled, wired, and tested circuit breaker, with major components being products of a single manufacturer, including bus and enclosure with accessories and features specified in this Section and indicated on the Drawings.
- B. Ratings:
 - 1. Three (3) phase, 4 wire, 480 volts, 2000 amperes, 65 k AIC, 60 hertz.
 - 2. Bus bars of tin-plated copper, mounted on supports of high-impact, non-tracking insulators
 - 3. Ground terminals per UL 891
- C. Enclosure:
 - 1. Existing field space constraints:
 - a. Freestanding, durable powder coated steel enclosure NEMA 1.
 - b. Dimensions of switchboard cabinet shall fit within existing electrical room space, as necessary to replace existing main fusible switch.
 - c. Take field measurements of existing room space and coordinate with other new electrical equipment layout, prior to submit shop drawings for the new switchboard.
 - 2. General:
 - a. Self-supporting structure, frame of die-formed 12-gauge steel.
 - b. Dead front.

- c. Bolt-on interior cover.
- d. Conduit entry: open bottom
- e. Non walk-in construction
- f. Chemically clean all surfaces before powder coating.
- g. Exterior surfaces finish powder coated with ANSI grey color

2.3 COMPONENTS

A. Main Circuit Breaker:

- 1. Fixed mounted, molded or insulated case, 2000-amp frame, with 2000-amp trip sensor, 100 percent rated, 480 volts, 65 k AIC
- 2. Conforming to UL 489.
- 3. Operating mechanism:
 - a. Quick-make, quick-break, non-welding silver alloy contacts.
 - b. Common Trip, Open and Close for multi-pole breakers such that all poles open and close simultaneously.
 - c. Mechanically trip free from the handle.
 - d. Trip indicating handle - automatically assumes a position midway between the manual ON and OFF positions to clearly indicate the circuit breaker has tripped.
 - e. Lockable in the "OFF" position.
- 4. Arc extinction:
 - a. In arc chutes.

B. Main Breaker Trip units:

- 1. Solid state with adjustable trip setting for the following:
 - a. Long time current pickup
 - b. Long time delay.
 - c. Short time pickup.
 - d. Short time delay.
 - e. Instantaneous Pickup
 - f. Ground fault pickup
 - g. Ground fault delay

C. Maintenance Selector Switch and Circuit for Reducing Arc Flash Incident Energy:

- 1. Separate Analog Circuit with power supply to detect peaks of incident energy, and it shall function in parallel with breaker's electronic trip unit, with the purpose of further reducing the time for instantaneous tripping of the circuit breaker.
- 2. On-Off selector manual switch.
- 3. LED indicating light "ON," when maintenance switch is activated.
- 4. Auxiliary LED indicating light "FAULT," when detected a large magnitude of short circuit current.
- 5. Auxiliary LED indicating light "Ground Fault," when detected a ground fault current.

D. Test Kit for Periodic Testing of Maintenance Selector Switch and Related Circuit.

1. Provide as separate spare part when testing system it is not an internal component of the protective device, for periodic verification of reliable functional condition.
 2. The test kit may use primary injection on the breaker's sensors.
 3. Provide all necessary hardware, materials, terminal blocks and special accessories and instructions for proper use of the system test kit.
 4. Product shall be furnished by the manufacturer of the circuit breaker:
 - a. Eaton model number "MTST230V."
 - b. Schneider Electric Restraint Interface Module S48890
 - c. General Electric, equivalent and applicable product.
- E. Cable Terminal Lugs:
1. Provide terminal lugs for the cables connecting to the line side of the circuit breaker and the load side of the circuit breaker.
- F. Wiring:
1. Provide all necessary internal wiring and circuit breaker protection for transient voltage surge protector and for power supply to maintenance selector switch.

2.4 ACCESSORIES

- A. Surge protective devices:
1. Provide surge protective devices mounted within the main circuit breaker cabinet
 2. Protective current limiting circuit breaker
 3. Status indicating pilot lights for each phase module and neutral
 4. Mounted within the main circuit breaker cabinet
 5. Dry contacts
 6. Characteristics
 - a. Single Pulse Surge Current Capacity Per Phase: 200,000 amperes.
 - b. L-N Mode: 100,000 amperes.
 - c. L-G Mode: 100,000 amperes.
 - d. N-G Mode: 100,000 amperes.
 - e. L-L Mode: 100,000 amperes.
 - f. Surge Life Cycle: 1.2 by 50 micro-seconds 20 kilovolt open circuit voltage, 8/20 micro-second waveform 10 kiloamperes short circuit current Category C3 Bi-Wave in accordance with ANSI C62.41 and C62.45.
 - g. Continuous Operating Voltage: Minimum 115 percent of nominal.
 - h. Suppression Voltage In Protective Modes: accordance with UL 1449
 7. Minimum wiring size No 6 AWG.
- B. Nameplates:
1. Provide Red laminated plastic with white letters approximately 1/2 inch high.
 2. plastic nameplate:
 - a. "MAIN SERVICE CIRCUIT BREAKER"
 3. Manufacturer's labels:
 - a. Serial number and Shop order number.
 - b. Bus rating and Date of manufacture

C. Metering system:

1. Include multifunction power metering as indicated on the Drawings.
2. Provide microprocessor based power meters with the following features:
 - a. Voltage readings among three phases
 - b. Current on each of three phases
 - c. Total kilowatt
 - d. Kilowatt Hours
 - e. Peak kilowatt demand
 - f. Frequency
 - g. Loss of single phase
 - h. Power factor.
3. Communication ports with auxiliary hardware for communication with remote SCADA network: Ethernet and RS-485
4. Provide the electric power meter equipment in isolated compartment, to separate the electric meter equipment from the main circuit breaker compartment, that main contain a high level of arc flash incident energy.

D. Warning signs:

1. Provide warning signs on the front of the cabinet.
 - a. Red laminated plastic engraved with white letters approximately 1/2 inch high.
 - b. Signs shall read:
 - 1) "WARNING-HIGH VOLTAGE-KEEP OUT."
 - 2) "DANGER ELECTRIC ARC FLASH HAZARD."
 - 3) Provide arc flash labels, including data of calories /cm², restricted distance, Power System Study and Arc Flash Study. Signs shall meet the requirements of NFPA 70E and NEC Article 110.16.
 - 4) Label shall read: "CIRCUIT BREAKER COVER PANEL SHALL NOT BE REMOVED WITH ENERGIZED CIRCUIT BREAKER"

E. Lugs:

1. UL listed for copper or aluminum conductors.
2. Rated for 75-degree Celsius conductors.
3. Lugs shall be of the compression type in design requiring a hydraulic press and die for installation.

F. Dead Front Cover Panels and Ventilation Louvers:

1. The interior dead front cover panels shall include ventilation louvers located towards the top of equipment, but not located in front area for circuit breaker operation.

2.5 SOURCE QUALITY CONTROL

- A. Completely assemble, wire and test switchboard at the factory, including testing of the circuit breaker, protective electronic trip unit and maintenance selector switch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide an equipment concrete pad, including the necessary width and depth for installation of the switchboard on existing electrical room
- B. Install the switchboard per the manufacturer's guidelines and submitted installation instructions.
- C. Provide adequate supports with anchors to equipment concrete pad and to the building structural wall.
- D. General:
 - 1. Furnish all cables, conduit, lugs, bolts, expansion anchors, sealants, and other accessories needed to complete the installation of the switchboard.
 - 2. Furnish components and equipment as required to complete the installation.
 - 3. Replace any hardware lost or damaged during the installation or handling to provide a complete installation.

3.2 FIELD ACCEPTANCE TESTING

- A. Provide the services of a third-party testing company and provide complete testing of the equipment, as necessary to verify adequate equipment condition according with the manufacturer data.
- B. Field testing shall be performed according to National Electrical Testing Association (NETA) standards, per specifications section 16950.

3.3 CIRCUIT BREAKER ADJUSTING AND SETTINGS

- A. Make all adjustments and circuit breaker trip settings according to the approved results of the Protective Device Coordination Study specified in section 16305.
- B. Arc-Flash Hazard Study:
 - 1. Provide alternative device settings to allow the Owner to select the desired functionality of the system:
 - a. Minimize the arc-flash energy by selective trip and time settings for equipment maintenance purposes.
 - b. Identify the arc-flash energy based upon the criteria of maintaining coordination and selectivity of the protective devices.

3.4 DEMONSTRATION AND TRAINING

- A. Demonstrate the circuit breaker operation to the Engineer's and Owner's satisfaction.

- B. Demonstrate the operation of the maintenance arc flash reduction switch.
 - 1. Additional safety considerations such as the following:
 - a. Impact of loss in downstream device coordination.
 - b. Nuisance breaker tripping.
 - c. Misunderstandings with sense of additional electrical safety
 - d. Equipment maintenance and repair planning.
 - e. Additional equipment labeling.
 - 2. Use of the testing kit or features to verify proper function, including the following:
 - a. Safety procedures
 - b. Equipment terminal block provisions for testing
 - c. Applicable primary current injection (if pertinent)
 - d. Adequate test readings

3.5 PROTECTION

- A. Protect equipment until final acceptance of the project.

END OF SECTION

SECTION 16442

GROUP-MOUNTED CIRCUIT BREAKER SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Free standing, dead-front type metal-enclosed distribution, low voltage switchboards, utilizing group mounted circuit protective devices.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following sections are related to the Work described in this Section. This list of related sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 16050 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 16050.
- B. Institute of Electrical and Electronic Engineers (IEEE).
- C. National Electrical Manufacturers' Association (NEMA):
 - 1. PB-2 - Dead-front Distribution Switchboards.
- D. Underwriters' Laboratories, Inc. (UL):
 - 1. 50 - Standard for Enclosures for Electrical Equipment.
 - 2. 891 - Switchboards.

1.3 DEFINITIONS

- A. As specified in Section 16050.

1.4 SYSTEM DESCRIPTION

- A. Switchboard will include a custom-made cabinet to fit in available electrical room space and it contains a main circuit breaker and branch circuit breaker that supply power to existing loads. Provide other accessories and features specified in this Section and indicated on the Drawings.

1.5 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 - 1. Furnish circuit breaker submittals as specified in:
 - a. Section 16412.
- C. Shop drawings:
 - 1. Manufacturer of switchboard.
 - 2. Manufacturer of all component parts of switchboard.
 - 3. Weight of switchboard.
 - 4. Dimensions:
 - a. Height.
 - b. Length.
 - c. Width.
 - 5. Layout drawings:
 - a. Complete, detailed, and scaled switchboard layout:
 - 1) Front panel.
 - 2) Sub-panels.
 - 3) Interior panels.
 - 4) Top and bottom conduit windows.
 - 6. Nameplate schedule.
 - 7. Bill of material.
 - 8. Ratings:
 - a. Voltage.
 - b. Phase.
 - c. Current.
 - d. Interrupting rating (circuit breakers and fuses).
 - e. Momentary current rating.
 - 9. List of recommended spare parts.
- D. Installation instructions:
 - 1. The written instructions must detail the complete installation of the switchboard including rigging, moving, and setting into place.
 - 2. Provide anchorage instructions and requirements for the switchboard based on the requirements at the project site as indicated in Section 16050:
- E. Operating and maintenance manuals:

1. Submit operating instructions and a maintenance manual for the switchboard(s) furnished and/or installed under this Contract.
2. Operating instructions:
3. Maintenance manual:
 - a. Furnish maintenance manuals with instructions covering all details pertaining to care and maintenance of all equipment as well as data identifying all parts.
 - b. Manuals to include but are not limited to the following:
 - 1) Adjustment and test instructions covering the steps involved in the initial test, adjustment, and start-up procedures.

1.6 QUALITY ASSURANCE

- A. As specified in Section 16050.

1.7 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.8 SEQUENCING

- A. Field measure and verify available electrical room space for the installation of the switchboard. Order the equipment with the necessary custom-made cabinet to fit in existing room.
- B. Conduct internal factory test to ensure that systems and equipment are functional and submit certified test results for Engineer's review.
- C. Conduct field acceptance test and submit results for Engineer's review.
- D. Submit manufacturer's certification that equipment has been properly installed and is fully functional for Engineer's review.
- E. Conduct the initial fault current study as specified in Section 16305 and submit results for Engineer's review.
- F. Formally energize, start-up and commission equipment:
 1. Start-up and commissioning shall be performed by the manufacturer's authorized representative.

1.9 SCHEDULING

- A. As specified in Section 16050.

1.10 WARRANTY

- A. As specified in Section 16050.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Breaker Enclosure, One of the following:
 - 1. Eaton/Cutler-Hammer, "Pow-R-Line C."
 - 2. Schneider Electric/Square D. "Power-Style QED."
 - 3. General Electric "Spectra Series".
- B. Main Circuit breakers: Same manufacturer as the switchboard.
 - 1. Eaton/Cutler-Hammer, "Electronic RMS – R Frame"
 - 2. Schneider Electric/Square D. "Masterpact NW"
 - 3. General Electric, "Power Break II.
- C. Main Circuit breakers trip units: Same manufacturer as the switchboard.
 - 1. Eaton/Cutler-Hammer, "Digitrip RMS-310 plus (+), with Maintenance Selector Switch for Reduce Energy Let Through (RELT)"
 - 2. Schneider Electric/Square D. "Electronic Trip – Micrologic, with Alternate Maintenance Setting (AMS) Switch (for Reduce Arc Flash Incident Energy)".
 - 3. General Electric, "Intelliguard Trip Unit," with Alternate Maintenance Setting (AMS) Switch (for Reduce Arc Flash Incident Energy)".
- D. Branch Circuit breakers: Same manufacturer as the switchboard.
 - 1. Protective features as specified in section 16412 and as indicated on the Drawings.

2.2 EQUIPMENT

- A. Ratings:
 - 1. Three Phase, 4 wire, 480 Volts, 2000 Amps, 65 kAIC, 60 hertz: As indicated on the Drawings.
- B. Main Circuit Breaker:
 - 1. Fixed mounted, molded or insulated case, 2000-amp frame, with 2000-amp trip sensor, 100 percent rated, 480 volts, 65 k AIC
 - 2. Conforming to UL 489.
 - 3. Operating mechanism:
 - a. Quick-make, quick-break, non-welding silver alloy contacts.
 - b. Common Trip, Open and Close for multi-pole breakers such that all poles open and close simultaneously.
 - c. Mechanically trip free from the handle.

- d. Trip indicating handle - automatically assumes a position midway between the manual ON and OFF positions to clearly indicate the circuit breaker has tripped.
 - e. Lockable in the "OFF" position.
 - 4. Arc extinction:
 - a. In arc chutes.
- C. Main Breaker Trip units:
 - 1. Solid state with adjustable trip setting for the following:
 - a. Long time current pickup
 - b. Long time delay.
 - c. Short time pickup.
 - d. Short time delay.
 - e. Instantaneous Pickup
 - f. Ground fault pickup
 - g. Ground fault delay
- D. Bus:
 - 1. General:
 - a. Silver-plated copper.
 - b. Bus cross-section per UL heat rise requirements.
 - c. Current density of 1,000 amperes per square inch.
 - d. Mounted on supports of high-impact, non-tracking insulators.
 - e. Phase A-B-C bus arrangement:
 - 1) Top-to-bottom, left-to-right, front-to-back throughout the switchboard.
 - f. Symmetrical short circuit current bracing of as indicated on the Drawings.
 - g. Continuous current rating as indicated on the Drawings.
 - 2. Ground bus:
 - a. Sized per UL 891.
- E. Enclosure:
 - 1. General:
 - a. Freestanding, durable powder coated steel enclosure NEMA 1.
 - b. Dimensions of switchboard cabinet shall fit within existing electrical room space, as necessary to replace existing main fusible switch.
 - c. Take field measurements of existing room space and coordinate with other new electrical equipment layout, prior to submit shop drawings for the new switchboard.
 - d. Self-supporting structures bolted together
 - e. Dead-front.
 - f. Conduit entry:
 - 1) Open-bottom.
 - 2) Removable top cover.
 - 2. Frame:
 - a. Die-formed 12-gauge steel.
 - 3. Covers:
 - a. Bolt-on.

- b. Code gauge steel.
 - c. Removable front covers.
 - 1) Held in place by captive screws.
- 4. Rating:
 - a. NEMA Type 1 with Gaskets.

2.3 COMPONENTS

- A. Branch Circuit breakers:
 - 1. General:
 - a. Molded case circuit breakers as specified in Section 16412.
 - 2. Feeder breakers:
 - a. Frame, trip and short circuit ratings and with adjustable settings for the large branch feeders per requirements on the drawings, including:
 - b. Long time current pickup
 - c. Long time delay.
 - d. Short time pickup.
 - e. Short time delay.
 - f. Instantaneous Pickup
- B. Wiring:
 - 1. Provide all necessary internal wiring, fuse blocks, and terminal blocks as required.
 - 2. Number all wires at each end and indicate wire numbers on shop drawings.
 - 3. Type SIS switchboard wire with at least 26 strands.
 - 4. Minimum wire size:
 - a. No. 14 for control circuits.
 - b. No. 12 for potential and current transformer circuits.
 - 5. Numbered and labeled in accordance with Section 16075.

2.4 ACCESSORIES

- A. Nameplates:
 - 1. Provide engraved plastic nameplates to identify:
 - a. Door mounted components.
 - b. Interior mounted devices.
 - 2. As specified in Section 16075.
 - 3. Engraved with the circuit number and circuit name as indicated on the Drawings.
- B. Warning signs:
 - 1. Voltage:
 - a. Provide a minimum of 2 warning signs on the front of the switchboard lineup and 2 on the back.
 - b. Red laminated plastic engraved with white letters approximately 1/2 inch high.
 - c. Signs shall read:
 - 1) "WARNING-HIGH VOLTAGE-KEEP OUT."

2. Arc flash:
 - a. Provide one warning sign for each switchboard compartment.
 - b. Signs shall have read a minimum of:
 - 1) "DANGER ELECTRIC ARC FLASH HAZARD."
 - 2) Signs shall meet the requirements of NFPA 70E and NEC Article 110.16.

C. Metering system:

1. Include metering as indicated on the Drawings.
2. Provide microprocessor based power meters with the following features:
 - a. Voltage readings among three phases
 - b. Current on each of three phases
 - c. Total kilowatt
 - d. Kilowatt Hours
 - e. Peak kilowatt demand
 - f. Frequency
 - g. Loss of single phase
 - h. Power factor.
3. Communication ports with auxiliary hardware for communication with remote SCADA network: Ethernet and RS-485

D. Surge Protective Device

1. Provide surge protective devices mounted within the main circuit breaker cabinet
2. Protective current limiting circuit breaker
3. Status indicating pilot lights for each phase module and neutral
4. Mounted within the main circuit breaker cabinet
5. Dry contacts
6. Characteristics
 - a. Single Pulse Surge Current Capacity Per Phase: 200,000 amperes.
 - b. L-N Mode: 100,000 amperes.
 - c. L-G Mode: 100,000 amperes.
 - d. N-G Mode: 100,000 amperes.
 - e. L-L Mode: 100,000 amperes.
 - f. Surge Life Cycle: 1.2 by 50 micro-seconds 20 kilovolt open circuit voltage, 8/20 micro-second waveform 10 kiloamperes short circuit current Category C3 Bi-Wave in accordance with ANSI C62.41 and C62.45.
 - g. Continuous Operating Voltage: Minimum 115 percent of nominal.
 - h. Suppression Voltage In Protective Modes: accordance with UL 1449
7. Minimum wiring size No 6 AWG.

E. Lugs:

1. For all external connections of No. 6 AWG or larger.
2. UL listed for copper or aluminum conductors.
3. Rated for 75-degree Celsius conductors.
4. Lugs shall be of the compression type in design requiring a hydraulic press and die for installation.

2.5 SOURCE QUALITY CONTROL

- A. Completely assemble, wire and test switchboard at the factory:
 - 1. Provide groups of wires leaving the shipping-assembled equipment with terminal blocks with suitable numbering strips.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. As specified in Section 16050.
- B. Install the equipment in accordance with the accepted installation instructions
- C. General:
 - 1. Furnish all cables, conduit, lugs, bolts, expansion anchors, sealants, and other accessories needed to complete the installation of the switchboard.
 - 2. Perform work in accordance with manufacturer's instructions and shop drawings.
 - 3. Furnish components and equipment as required to complete the installation.
 - 4. Replace any hardware lost or damaged during the installation or handling to provide a complete installation.

3.2 FIELD QUALITY CONTROL AND ACCEPTANCE TESTING

- A. As specified in Section 16050.
- B. Provide the services of a third-party testing company and provide complete testing of the equipment, as necessary to verify adequate equipment condition according with the manufacturer data.
- C. Field testing shall be performed according to National Electrical Testing Association (NETA) standards, per specifications section 16950.

3.3 CIRCUIT BREAKER ADJUSTING AND SETTINGS

- A. Make all adjustments and circuit breaker trip settings according to the approved results of the Protective Device Coordination Study specified in section 16305.
- B. Arc-Flash Hazard Study:
 - 1. Provide alternative device settings to allow the Owner to select the desired functionality of the system:
 - a. Minimize the arc-flash energy by selective trip and time settings for equipment maintenance purposes.
 - b. Identify the arc-flash energy based upon the criteria of maintaining coordination and selectivity of the protective devices.

3.4 CLEANING

- A. As specified in Section 16050.

3.5 DEMONSTRATION AND TRAINING

- A. As specified in Section 16050.
- B. Demonstrate the operation to the Engineer's and Owner's satisfaction.
- C. Demonstrate the operation of the maintenance arc flash reduction switch.
 - 1. Additional safety considerations such as the following:
 - a. Impact of loss in downstream device coordination.
 - b. Nuisance breaker tripping.
 - c. Misunderstandings with sense of additional electrical safety
 - d. Equipment maintenance and repair planning.
 - e. Additional equipment labeling.
 - 2. Use of the testing kit or features to verify proper function, including the following:
 - a. Safety procedures
 - b. Equipment terminal block provisions for testing
 - c. Applicable primary current injection (if pertinent)
 - d. Adequate test readings

3.6 PROTECTION

- A. As specified in Section 16050.

END OF SECTION

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SECTION 16491
TRANSFER SWITCHES

GENERAL

1.1 SUMMARY

- A. Section includes requirements for:
 - 1. Manual Transfer Switch
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following sections are related to the Work described in this Section. This list of related sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.

1.2 REFERENCES

- A. Underwriters Laboratories (UL):
- B. UL 1008 - Transfer Switch Equipment.
- C. Transfer switch shall be labeled for Service Entrance.

1.3 DEFINITIONS

- A. Specific Definition:
 - 1. N/A

1.4 SYSTEM DESCRIPTION

- A. Provide transfer switch capable of transferring load circuits to and from standby power.
- B. Sequence of Operation:
 - 1. N/A – Manual transfer of power to standby power system.

1.5 SUBMITTALS

- A. Furnish submittals in accordance with Sections 01330.
- B. Product Data:
 - 1. Manufacturer of transfer switch.
 - 2. Manufacturer of all component parts of transfer switch.
 - 3. Weight of transfer switch.
 - 4. Dimensions: The new transfer switch shall fit in available space to replace the existing transfer switch. Measure and verify existing space and field dimensions prior to submit shop drawings of new equipment. Submit statement confirming the verification of field dimensions, including the following:
 - a. Width.
 - b. Length.
 - c. Height.
 - 5. Bill of material.
 - 6. Description of operation.
 - 7. Ratings:
 - a. Voltage.
 - b. Phase.
 - c. Current.
 - d. Number of poles.
 - 8. List of recommended spare parts.
 - 9. Name of dealer's repair facility and parts stocking agreement with the factory:
 - a. Agreement shall outline in detail the manufacturer's parts stocking requirements and the method by which the manufacturer's representative verifies that the stock is at an acceptable level.
 - b. Agreement should also outline the method by which the manufacturer's representative determines that the service personnel meet factory standards.
 - c. A toll-free or local phone number with 24/7 emergency monitoring/call back is required.
- C. Shop Drawings:
 - 1. Layout drawings:
 - a. Complete, detailed, and scaled transfer switch layout:
 - 1) Front panel.
 - 2) Sub-panels.
 - 3) Interior panels.
 - 4) Top and bottom conduit windows.
 - 2. Complete electrical wiring diagrams:
 - a. Point-to-Point connections.
 - b. With wire numbers.
 - 3. Complete interface and connection diagrams.
 - 4. Detail of interface connections to Switchboard, transfer switch, MCC, engine generators, etc.
- D. Operation and Maintenance Manuals:

1. Submit operating instructions and a maintenance manual for the transfer switch furnished and/or installed under this contract.
2. Operating instructions:
 - a. Printed and framed instruction chart suitable for wall hanging. The chart must detail the operational functions of all normally used controls that have been placed on the front panel of the transfer switch.
3. Maintenance manual:
 - a. Furnish maintenance manuals with instructions covering all details pertaining to care and maintenance of all equipment as well as data identifying all parts.
 - b. These manuals shall include but are not limited to the following:
 - 1) Adjustment and test instructions covering the steps involved in the initial test, adjustment, and start-up procedures.
 - 2) Detailed control instructions, which outline the purpose and operation of every control device used in normal operation.
 - 3) Description of the sequence of operation that outlines the steps that follows during commercial power failure, and fault conditions, and return of commercial power conditions.
 - 4) All schematic, wiring, and external diagrams.
 - 5) Drawing shall be furnished in a reduced 11 inches by 17 inches format and shall be fully legible at that drawing size.

E. Test Reports:

1. Manufacturer to furnish a certified report after the shop tests.
2. Manufacturer's test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity meets the minimum UL listed withstand and close into fault ratings.

F. Calculations:

1. Complete structural calculations based on requirements at the project site as required by specification Section 16050 with equipment anchorage details.

G. Warranty:

1. Submit documentation verifying the equipment warranty.

1.6 QUALITY ASSURANCE

- A. Refer to additional requirements in Section 16050.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 16050.

- B. Ship the equipment to the job site on a dedicated air ride vehicle, to prevent equipment damage, plus handling means to facilitate the Contractor to utilize onsite off-loading equipment.

1.8 PROJECT OR SITE CONDITIONS

- A. Refer to Section 16050.

1.9 WARRANTY

- A. Provide equipment warranty in accordance with requirements specified in Section 16050.

1.10 SYSTEM STARTUP

- A. Refer to Section 16050.

PRODUCTS

1.11 MANUFACTURERS

- 1. Transfer Switch: One of the following:
 - a. Boltswitch Series GT
 - b. Or Equal

1.12 EQUIPMENT

- A. Manual transfer switch:
 - 1. Electrical ratings:
 - a. 4-pole.
 - b. 480 VAC.
 - c. 60 hertz.
 - d. Ampere rating as indicated on the Drawings.
 - e. Current Rating: 200,000 amperes RMS minimum.
 - f. Break-Before-Make Operating Mechanism
 - g. Service Rated
 - 2. Enclosure:
 - a. Freestanding, steel enclosure NEMA 3R.
 - b. Dimensions of transfer switch cabinet shall fit within existing electrical room space, as necessary to replace existing transfer switch.
 - c. Take field measurements of existing room space and coordinate with other new electrical equipment layout, prior to submit shop drawings for the new automatic transfer switch.
 - 3. Capable of switching all classes of load.
 - 4. Rated for continuous duty when installed in a non-ventilated enclosure.
 - 5. Provide contactors rated for continuous duty.
- B. Identify control wire terminations by tubular sleeve-type markers at both ends in accordance with the shop drawings.

1.13 ACCESSORIES

- A. N/A

1.14 SOURCE QUALITY CONTROL

- A. Test Procedures: In accordance with UL-1008:
 - 1. Testing: Certified by Underwriters Laboratories or a nationally-recognized independent testing laboratory. During the 3-cycle withstand tests, there shall be no contact welding or damage.
- B. Perform tests on identical samples without the use of current limiting fuses.
- C. Oscillograph traces across the main contacts shall verify that contact separation has not occurred and there is contact continuity across all phases after completion of the test.
- D. Manufacturer to submit test reports upon request.
- E. When conducting temperature rise tests in accordance with UL-1008, include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

EXECUTION

1.15 INSTALLATION

- A. See work restrictions and constraints specified in section 01140, which apply to the installation of the new service entrance equipment, including the automatic transfer switch.
- B. The transfer switch must be installed in tested in a short period of time, including working through non-regular hours, as necessary to expedite the replacement of existing service entrance equipment and minimize the interruption of the existing electrical service entrance No. 1.

1.16 FIELD QUALITY CONTROL

- A. Refer to Section 16050.

1.17 CLEANING

- A. Refer to Section 16050.

1.18 DEMONSTRATION AND TRAINING

- A. Refer to Section 16050.
- B. Demonstrate operation of transfer switch equipment in joint effort with testing of the new service entrance switchboard, specified in section 16440 and testing of the standby power generator.
- C. Provide training of Owner personnel, including details for the basic technical troubleshooting and maintenance, plus comprehensive training for the operation of the transfer switch in conjunction with available utility power and the standby generator power.

1.19 PROTECTION

- A. Refer to Section 16050.

END OF SECTION

SECTION 16500
LIGHTING SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install a complete lighting system ready for operation as shown on the Drawings and as specified herein.

1.2 RELATED WORK

- A. Panelboards are existing.
- B. Transformers are existing.
- C. Conduit is included in Section 16110.
- D. Wire is included in Section 16120.
- E. Time switches, photoelectric controls and contactors are existing.
- F. All concrete and reinforcing steel required for exterior lighting pole bases shall be as specified under Division 3, but the responsibility of furnishing and installing the material shall be that of Division 16.

1.3 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300. Submittals shall include those set forth in Section 16000, Paragraph 1.02.

1.4 REFERENCE STANDARDS

- A. All lighting fixtures shall be in accordance with the National Electrical Code (NEC) and shall be constructed in accordance with the latest edition of the Underwriters Laboratories (UL) "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be UL labeled.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lighting Fixtures

1. Lighting fixture types shall be furnished as required by the "Lighting Fixture Schedule" on the Drawings. The catalog numbers are given as a guide to the design and quality of fixture desired. Equivalent designs and approved equal quality fixtures of other manufacturers will be acceptable upon approval by the Engineer.

B. Lamps

1. Fluorescent lamps shall be medium bi-pin, recessed, double contact, rapid start, tri-phosphor, 4100 Kelvin and compact types all as shown on the "Fixture Schedule."
2. Metal halide lamps shall be clear and of the size and type as shown on the "Lighting Fixture Schedule."
3. Incandescent lamps shall be inside frosted, halogen, 2500-hour minimum life with medium base.
4. All lamps shall be of one manufacturer and shall be as manufactured by Osram/Sylvania Electric Products, Inc.; General Electric Co.; North American Philips Lighting Corp. or approved equal.

C. Ballasts

1. Fluorescent ballasts shall be electronic, high-frequency, full-output rapid-start type for use on 265 mA, T8 lamps.
 - a. All ballasts shall be UL listed, ETL certified, Class "P", high power factor (minimum 0.90).
 - b. Ballasts shall have a "A" sound rating or better.
 - c. All ballasts used in exterior applications shall have a minimum starting temperature of 0 degrees F unless otherwise specified.
 - d. All interior ballasts shall have a minimum starting temperature of 50 degrees F.
 - e. Ballasts shall be series wired type and designed to operate the number and length of lamps specified.
 - f. The total harmonic distortion (THD) of each ballast shall be in accordance with the requirements of the utility company and in no case shall it be less than 10 percent THD.
 - g. Ballasts shall have a minimum ballast factor of 0.88.
 - h. Ballasts shall have nominal power factor 0.90 or higher.
 - i. Ballasts shall have a maximum lamp current crest factor of 1.7.
 - j. Ballast shall provide normal rated life for the lamp specified.
 - k. All electronic ballasts shall be warranted for parts and replacement for 1 full year from the date of installation.
 - l. Electronic ballasts shall be as manufactured by Advance, Model Mark V, similar by Valmont; Osram/Sylvania; MagneTek or approved equal.
2. Metal halide ballast shall be of the constant voltage auto-transformer type of the correct size and voltage for the fixture it is to serve as shown on the "Lighting

Fixture Schedule.” All ballasts shall be as manufactured by Holophone Lighting; MagneTek Universal Manufacturing; Advance Transformer Co. or approved equal.

D. Flexible Fixture Hangers

1. Flexible fixture hangers used in non-hazardous areas shall be type ARB and flexible fixture supports used in hazardous areas shall be Type ECHF as manufactured by the Crouse-Hinds Co., similar by Appleton Electric Co.; Killark Electrical Mfg. Co. or approved equal.
2. Where required in Section 16000 all pendent mounted and recessed in suspended ceilings, recessed lighting fixtures shall be provided with four anti-sway supports to meet Type II seismic requirements.

E. Lamp Changing Equipment

1. Lamp changing equipment shall be able to handle BT-37, E-18, E-23-1/2 and E-28 type H.I.D. lamps in open luminaries.
2. Equipment shall consist of three 5-ft steel poles each similar and equal to McGill Catalog No. 160-P and two lamp holders similar and equal to McGill Catalog Nos. 158C and 161C.

F. Emergency Lighting Battery Units

1. N/A

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.
- B. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.
- C. Fixtures noted to be installed flush in suspended ceilings shall be of mounting types suited for the type ceiling involved. It shall be the responsibility of the electrical contractor to verify the ceiling types prior to ordering fixtures.
- D. Flexible fixture hangers shall be used for all pendant-mounted fixtures. Fixtures 2-ft long and larger shall be supported with a minimum of two fixture hangers.
- E. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.
- F. Exterior lighting poles shall be mounted plumb.

- G. Fixture locations are shown on the Drawings in approximate locations; however, exact locations shall be coordinated so as to avoid conflicts with HVAC ducts, equipment and other obstacles.

3.2 REPLACEMENT

- A. Lamps (except for H.I.D.) used during the building construction, prior to 2 weeks from completion of the work, shall be removed and replaced with new lamps.

3.3 CLEANING UP

- A. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.
- B. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION 16500

SECTION 16600
UNDERGROUND SYSTEM

GENERAL

1.1 SCOPE OF WORK

- A. Furnish and install a complete underground system of raceways, manholes and handholes as shown on the Drawings and as specified herein.

1.2 RELATED WORK

- A. All concrete and reinforcing steel shall be as specified in Division 3, but the responsibility of furnishing and installing the material shall be that of this Section.
- B. All trenching and surface restoration shall be as specified in Division 2, but the responsibility of furnishing and installing the material shall be that of this Section.

1.3 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data, for the following:
 - 1. Handholes and manholes
 - 2. Plastic duct spacers
 - 3. Handhole and manhole frames and access doors

1.4 REFERENCE STANDARDS

- A. Access door: American Society for Testing and Materials (ASTM), ASTM A36-93a; Standard Specification for Structural Steel.

PRODUCTS

1.5 MATERIALS

- A. Raceways shall be Schedule 40 polyvinyl chloride conduit encased in concrete, except that rigid steel conduit shall be used for shielded wire (Analog Signals). Refer to Section 16110 for material requirements.

- B. Cable racks, supports, pulling-in irons, manhole steps and hardware shall be galvanized steel as manufactured by Line Materials Co. or approved equal.
- C. Handholes and manholes shall be precast concrete, heavy-duty type, designed for a Class H-20 wheel load and conform to ASTM C478. Precast units shall be as manufactured by Chase Precast Corp.; American Precast Co. or approved equal and constructed to dimensions as shown on the Drawings.
- D. Cover shall be 1/4-inch (6.3mm) aluminum diamond pattern. Lifting mechanisms shall be compression spring in telescopic tube. A turn/lift handle with spring-loaded detent ball shall be provided.
- E. Frames and covers shall be 1/4-inch (6.3mm) extruded aluminum with bend down anchor tabs around the perimeter. A continuous EPDM gasket shall be mechanically attached to the aluminum frame to create a barrier around the entire perimeter of the cover. Hinges and lock bolts shall be tamper-proof Type 316 stainless steel. Provide a 1-1/2-inch drain coupling as shown on the Drawings.
- F. Ground rods and other grounding materials and methods shall be as specified in Division 16.
- G. Plastic duct spacers shall be as manufactured by Carlon or approved equal.

EXECUTION

1.6 INSTALLATION

- A. Install raceways to drain away from buildings. Raceways between handholes shall drain toward the handholes. Raceway slopes shall not be less than 3-in per 100-ft.
- B. Reinforce raceway banks as shown on the Drawings.
- C. Lay raceway lines in trenches on mats of bank gravel not less than 6-in thick and well grade.
- D. Use plastic spacers located not more than 4-ft apart to hold raceways in place. Spacers shall provide not less than 2-in clearance between raceways.
- E. The minimum cover for raceway banks shall be 24-in unless otherwise permitted by the Engineer.
- F. Make raceway entrances to buildings, handholes with steel conduit not less than 10-ft long. Conduits run below floor slabs in slab-on-grade construction shall be Galvanized rigid steel.
- G. Raceway terminations at handholes shall be with insulated throat grounding bushings for steel conduit.

- H. Where bends in raceways are required, use long radius elbows, sweeps and offsets.
- I. Swab all raceways clean before installing cable.
- J. Plug spare raceways and seal them watertight at all handholes, buildings and structures.
- K. Seal the ends of raceways and make watertight at all manholes, buildings and structures.
- L. Install pulling-in irons opposite all raceway entrances to manholes.
- M. Train cables in handholes and support and restrain them on racks and hooks. Furnish inserts on all handhole walls for mounting future racks as well as racks required for present installation.
- N. Rigid galvanized steel conduit shall be used for elbows and risers at the utility pole for electrical and telephone service conduits.
- O. Rigid galvanized steel elbows shall be used for primary and secondary conduit entrances at transformer pads.

END OF SECTION 16600

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SECTION 16660
GROUNDING SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC), as shown on the Drawings and as specified herein.
- B. All raceways, conduits and ducts shall contain equipment-grounding conductors sized in accordance with the NEC. Minimum sizes shall be No. 12 AWG.

1.2 SUBMITTALS

- A. Submit to the Engineer, in accordance with Division 1, shop drawings and product data, for the following:
 - 1. Manufacturer's name and catalog data for ground rods and exothermic welding methods and materials.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conduit shall be as specified under Section 16110.
- B. Wire shall be as specified under Section 16120.
- C. Ground rods shall be 3/4-in by 10-ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld or approved equal.
- D. Grounding conduit hubs shall be malleable iron type, manufactured by Thomas & Betts Co.; Catalog No. 3940 (3/4-in conduit size), similar to Burndy; O.Z. Gedney Co. or approved equal, and of the correct size for the conduit.
- E. Waterpipe ground clamps shall be cast bronze saddle type, manufactured by Thomas & Betts Co. Cat. No. 2 (1/2-in, 3/4-in, or 1-in size), similar to Burndy; O.Z. Gedney Co. or approved equal, and of the correct size for the pipe.

- F. Buried grounding connections shall be by Cadweld process, or approved equal exothermic welding system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Run grounding electrode conductors in rigid steel conduits. Bond the protecting conduits to the grounding electrode conductors at both ends. Do not allow water pipe connections to be painted. If the connections are painted, disassemble them and re-make them with new fittings.
- B. Install equipment-grounding conductors with all feeders and branch circuits.
- C. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus, as shown on the Drawings.
- D. Ground wire connections to structural steel columns shall be made with long barrel type one-hole heavy duty copper compression lugs, bolted through 1/2-in maximum diameter holes drilled in the column web, with stainless steel hex head cap screws and nuts.
- E. Metal conduits stubbed into a motor control center shall be terminated with insulated grounding bushings and connected to the motor control center ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250-122, except that a minimum No. 12 AWG shall be used.
- F. Liquid tight flexible metal conduit in sizes 1-1/2-in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.
- G. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250-66.
- H. Drive grounding electrodes as shown on the Drawings and as noted below.
- I. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded and bonded in accordance with the NEC.
- J. Seal exposed connections between different metals with No-Oxide Paint Grade A or approved equal.
- K. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other

magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

- L. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.
- M. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THW green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.
- N. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12 inch (6.4-by-50-by-300-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- O. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment-grounding conductor with supply branch-circuit conductors.
- P. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- Q. Pad-Mounted Transformers and Switches: Install a minimum of two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with the equipment by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 4/0 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches (450 mm) below grade and 6 inches (150 mm) from the foundation. See drawings for additional requirements.
- R. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, non-shrink grout.
- S. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum,

stranded, hard-drawn copper conductor. Train conductor's level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.2 INSPECTION AND TESTING

- A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use Biddle Direct Reading Earth Resistance Tester or equivalent test instrument to measure resistance to ground of the system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.
- C. All test equipment shall be provided under this Section and approved by the Engineer.
- D. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.
- E. Testing shall be performed before energizing the distribution system.
- F. A separate test shall be conducted for each building or system.
- G. Notify the Engineer immediately if the resistance to ground for any building or system is greater than 5 ohms.
- H. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system, but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
 - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identifying each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results.
 - 4. Describe measures taken to improve test results.
 - a. Equipment Rated 500 kVA and Less: 10 ohms
 - b. Equipment Rated 500 to 1,000 kVA: 5 ohms
 - c. Equipment Rated more than 1,000 kVA: 3 ohms
 - d. Manhole Grounds: 10 ohms

5. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16660

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SECTION 16670
LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Design and installation of a complete lightning protection system.
 - 2. Materials and components for the lightning protection system.
- B. Related sections:
 - 1. Section 01330 - Submittals
 - 2. Section 01770 - Closeout Procedures
 - 3. Section 16660 - Grounding System

1.2 REFERENCES

- A. Lightning Protection Institute (LPI).
- B. National Fire Protection Association (NFPA):
 - 1. 780 - Standard for the Installation of Lightning Protection Systems.
- C. Underwriters Laboratories, Inc. (UL):
 - 1. 96 - Standard for Lightning Protection Components.
 - 2. 96A - Standard for Installation Requirements for Lightning Protection Systems.

1.3 DEFINITIONS

- A. Specific definitions:
 - 1. LPI: Lightning Protection Institute.

1.4 SYSTEM DESCRIPTION

- A. Retain the services of a lightning protection contractor to design, furnish, and install, supervise the installation of a complete lightning protection system, connected to the facility grounding system.
- B. Lightning protection system: NFPA 780; Class I, II UL 96A; master labeled system(s) protecting roof-mounted mechanical equipment, chimneys and stacks and penthouse roofs, consisting of:
 - 1. Air terminals on roof(s).

2. Bonding of structure and other metal objects.
 3. Grounding electrodes.
 4. Interconnecting conductors.
- C. Connect the lightning protection system to the facility grounding electrode:
1. Provide common ground connections as necessary to the electric and telephone service conductors and TV and radio and antennas.
- D. The installing contractor is responsible for all costs associated with UL inspection of the lightning protection system, including any costs associated with re-inspection necessary to obtain the UL 96A Master Label.

1.5 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
1. Provide samples and pertinent catalog data for:
 - a. Air terminals.
 - b. Conductors.
 - c. Connectors.
 - d. Accessories.
 - e. Include dimensions and materials of each component, and include indication of listing in accordance with UL 96.
- C. Shop drawings:
1. Including but not limited to:
 - a. Layout of air terminals with the respective configuration of the zone of protection.
 - b. Grounding electrodes, and bonding connections to structure and other metal objects.
 - c. Type, size and locations for:
 - 1) Terminal.
 - 2) Electrode.
 - 3) Conductor.
 - d. Conductor routing details.
 - e. Connection details.
 - f. Termination details.
 - g. Applicable air terminal and other calculations.
 2. Details showing installation of air terminals, conductors, and connectors.
- D. Certificates:
1. Submit 2 notarized photocopies of the completed Application for UL Master Label for each lightning protection system.
 2. Submit written confirmation of having obtained UL Master Label and LPI certification for each lightning protection system.

3. Photocopy of UL and LPI Installers' Certificate(s) for installation of lightning protection systems.
4. Written confirmation regarding the system manufacturer's and the system installer's membership in the Lightning Protection Institute.
5. Proof of the manufacturer and installer having been UL-listed and LPI-certified for at least 5 years.

E. Record Documents:

1. Provide Record Documents as specified in Sections 01770 and 16050.
2. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.
3. Manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

A. As specified in Section 16050.

B. Conform to the requirements of the UL and NFPA standards for lightning protection systems:

1. Components shall be listed in accordance with UL 96.

C. Manufacturer's qualifications:

1. Company specializing in lightning protection equipment with minimum 5 years documented experience and a fully certified manufacturer member of the Lightning Protection Institute:
 - a. Listed in section "Lightning Conductor, Air Terminals and Fittings" of the UL "Electrical Construction Materials Directory" for at least 5 years previous to this Contract's bid opening date.

D. Installers qualifications: Authorized installer for manufacturer with minimum 5 years documented experience and member of the Lightning Protection Institute. Member of the UL quality control program listed in section "Lightning Protection Installation" of the UL "Electrical Construction Materials Directory" for at least 5 years previous to this Contract's bid opening date and LPI-certified installer for installation of lightning protection systems for at least 5 years previous to this Contractor's bid opening date.

E. The lightning protection system shall meet the applicable requirements of NFPA 780.

F. Upon completion of installation the lightning protection contractor to have the building lightning system physically inspected by UL and furnish a UL Master Label for the building:

1. Application for the UL Master Label without a physical inspection by UL is unacceptable.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.8 SEQUENCING

- A. Coordinate Work with other trades to ensure neat, correct, and unobtrusive installation.
- B. Coordinate the Work of this Section with roofing and exterior and interior finish installations.

1.9 WARRANTY

- A. As specified in Section 16050.

1.10 SYSTEM START-UP

- A. As specified in Section 16050.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. One of the following or equal:
 - 1. Erico.
 - 2. Thompson Lightning Protection, Inc.
 - 3. Harger Lightning and Grounding.
 - 4. VFC, Inc.

2.2 MATERIALS

- A. Air terminals:
 - 1. Material: Copper. Aluminum.
 - 2. Size: 3/8-inch by 18-inch minimum extending a minimum of 12 inches above the object to be protected.
 - 3. On flat or walkable roofs, provide air terminals with:
 - a. Mushroom type blunt tip incapable of impalement if fallen upon.
 - b. Spring mounted and capable of being pushed flush to the roof.
 - 4. Air terminals on stacks and chimneys:
 - a. Protected from corrosion.
 - b. Sized in accordance with UL and NFPA requirements.
 - c. Lead-coated copper.
 - 5. Air terminal bases:

- a. Cast bronze with bolt pressure cable connections securely mounted with stainless steel screws and bolts.
- B. Ground rods:
 - 1. As specified in Section 16660.
- C. Ground plate: Copper.
- D. Conductors:
 - 1. Perimeters:
 - a. Copper
 - 2. Down conductors:
 - a. Copper.
 - 3. At least 32 strands of 17 gauge or larger copper wire weighing not less than 215 pounds per 1000 feet.
 - 4. UL listed for the application.
 - 5. Copper, Cable, Strip, Solid rod:
 - a. Perimeters and down conductors:
 - 1) At least 32 strands of 17 gauge or larger copper wire weighing not less than 215 pounds per 1,000 feet.
 - 2) UL listed for the application.
 - 6. Cable fasteners:
 - a. Electrolytically compatible with conductors and mounting surface:
 - 1) Spaced in accordance with LPI and NFPA requirements.
- E. Connectors and splicers: Bronze -Aluminum:
 - 1. Make connections between dissimilar metals with approved bimetallic connectors.
- F. Miscellaneous materials:
 - 1. Copper of type and size recommended by the manufacturer of the lightning protection system.
 - 2. Stainless steel bolts, screws, and other threaded fasteners.
- G. System: Aluminum components for aluminum roofing, compatible with aluminum roofing materials; mechanical connectors and transition joints between aluminum and copper, suitable, properly installed by trained personnel.

2.3 EXAMINATION

- A. It is the responsibility of the lightning protection subcontractor to review the electrical system design, and provide any and all additional equipment and materials needed in order to construct a master labeled UL lightning protection system.
- B. Verify that surfaces are ready to receive work.
- C. Verify that field measurements are as indicated on the Drawings and as specified elsewhere in this Section.

- D. Protect elements surrounding Work of this Section from damage or disfiguration.
- E. Install systems in accordance with manufacturer's instructions unless otherwise specified in this Section.
- F. Installation must be made under the supervision of and by an LPI certified master installer.
 - 1. Physically connect lightning protection equipment to structural roof framing members including metal deck.
 - 2. Do not attach lightning protection equipment to rigid roof insulation.
- G. Conductor installations:
 - 1. Install the lightning protection roof system(s) grounding and bending conductors exposed on flat roof areas and concealed at ridge roof areas.
 - 2. Install main downloads completely concealed and sleeved.
 - 3. Other than for the purpose of protecting download conductors from damage up to 6 feet above grade level, do not use exposed conduits to conceal the downloads on the exterior of the building(s) outside walls.
 - 4. Use minimum 1-inch PVC conduits to protect lightning system conductors from damage.
- H. Clearances: Assure 6-foot minimum distance required by NEC:
 - 1. From lightning rod conductors to non-current-carrying metal parts of electrical equipment unless they are bonded to the rods.
 - 2. From lightning system conductors to open conductors of communication systems.
 - 3. From lightning protection grounding electrodes to electrodes of other grounding systems.
- I. Extend air terminals a minimum of 12 inches above object to be protected.
- J. Maintain horizontal or downward coursing of main conductor and ensure that bends have at least an 8-inch radius and that no bend of a conductor forms an included angle of less than 90 degrees.
- K. Install ground electrodes not less than 1 foot below grade and not less than 2 feet from foundation walls.
- L. Interconnection of metals:
 - 1. Bond all metal bodies within 6 feet of the conductor to the system with approved fittings and conductor.
 - 2. Connections between dissimilar metals shall be made with approved bimetallic connections.
 - 3. Bond metal bodies of inductance located within 6 feet of a conductor or object with secondary bonds.
- M. Bond all isolated metallic bodies at or below the roof subject to inductance and within 6 feet of lightning protection system conductors.

- N. Provide necessary common grounds between the lightning protection system and the electric and telephone service entrance wires, TV and radio antenna grounds.
- O. Ensure that air terminals are installed to withstand calculated wind force due to 100 miles per hour winds or as specified in Section 01614, whichever is greater with a 1.3 gust factor without structural damage and without damage to integrity of the lightning protection system.
- P. Protect down conductors entering corrosive soil against corrosion by a protective coating for not less than 3 feet above grade level and for the entire length below grade level until connection to the ground ring and rods.

2.4 FIELD QUALITY CONTROL

- A. Provide the services of UL to physically inspect the entire lightning protection system and issue the UL Master Label:
 - 1. Furnish UL Master Label as evidence that the installation has met with UL 96A code requirements.
- B. Obtain LPI system certification reports and LPI system certification.

END OF SECTION

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SECTION 16775

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of variable frequency drives work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. All Variable Frequency Drives (Drives) shall be provided with the complete control and protective functions listed in part 2 of this specification.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's drive specifications and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- C. Maintenance Data: Submit Operation and Maintenance Manual and parts lists as specified.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. Handle variable frequency drives and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged drives or components; replace with new.
- B. Store drives and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's installation instructions for unloading drives and moving them to final location.

1.5 WARRANTY

- A. All units shall be warranted for a period of twelve (12) months from the date of Engineer's acceptance and beneficial use of the system by the Owner. Any warranty expense during that time shall be born entirely by the manufacturer, including any travel costs or living expenses necessary to repair in warranty equipment.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVE:

- A. The speed control for variable speed pumps shall be variable frequency drives suitable for installation as shown on the drawings.
- B. The variable frequency drives shall include all internal auxiliaries required to meet the functional specifications.
- C. The variable frequency drives shall conform to all requirements stipulated in this section and Division 16 - Electrical, and shall be designed for an extended speed range of 60% to 100% of full load motor speed.
- D. Each drive shall have the following design features.
 - 1. The drive shall employ microprocessor-based inverter logic isolated from power circuits.
 - 2. The drive shall employ a diode bridge on the input, SCR inputs are not acceptable.
 - 3. All drives above 30HP shall employ a DC bus inductor to reduce line harmonics and improve power factor.
 - 4. The drive shall employ a common Main Control Board from 5HP to 500HP.
 - 5. The drive shall employ a Pulse Width Modulated (PWM) inverter system using third generation IGBT's to minimize audible motor noise and increase overall performance.
 - 6. The drive shall employ a switching logic power supply operating from the DC bus.
 - 7. The drive shall employ phase to phase and phase to ground MOV protection.
 - 8. The drive shall have a documented 28 years mean time between failure. A letter certifying this shall be provided with the bid and as part of the formal submittals.
 - 9. The drive shall be provided with Modbus RTU serial communications as a standard.
 - 10. The drive shall be designed to have a minimum of 2khz carrier frequency without de-rating and provide selectable PWM Swing carrier patterns to minimize audible motor noise.
 - 11. All drives 50HP and above shall be provided as 12-pulse dual rectifier input design. Passive harmonic filters are not acceptable. Multi-pulse technologies utilizing auto-wound transformers are not acceptable. Active harmonic rectification technology is not acceptable. Drives less than 50HP shall be provided with a 5% input line reactor.
 - 12. The drive shall be designed to operate on an AC line which may contain line notching and up to 10% harmonic distortion.

13. The drive shall be designed to shut down with no component failure in the event of an output phase to phase or phase to ground short circuit and provide annunciation of the fault condition.
14. The drive shall be designed with a common control connection diagram for all ratings.
15. The drive shall be designed such that the inverter section power semiconductors do not require commutation capacitors.
16. The drive shall be designed to be variable torque rated. The drive shall supply 120% of rated current for up to one minute.
17. The drive shall be designed to allow all parameter adjustments to be made with the door closed.
18. Drives located outdoors shall be provided in a NEMA 3R (Marine grade aluminum, powder coated white) enclosure. Drives located indoors shall be provided in a ventilated and filtered type 1 enclosure.
19. The drive shall be designed with a common Customer Interface for all horsepower ratings. The Interface shall include an LCD digital display, programming keypad and operator keys option.
20. The drive shall provide multiple programmable stop modes, including ramp, coast, brake and S-curve.
21. The drive shall be designed to have an adjustable output frequency up to 60 Hz $\pm 10\%$.

E. The drives shall have the following features.

1. Interface: The drive shall provide a removable Human Interface Module with integral display to show drive operating conditions, adjustments, and fault indications. The display shall be removable under power without causing a drive fault and be visible and operable without opening the enclosure door. The display shall consist of three lines of 16-character, alphanumeric, back-lit LCD with the display being configurable for three display values simultaneously with customized multi-lingual test, all scaled to user units.
2. Volts per Hertz Adjustment: Drive programming shall provide the ability to fully configure the volts per hertz for squared, cubed, straight line or full custom patterns.
3. Current Limit: The drive shall provide a programmable current limit from 20% to 150% of variable torque rating. Current limit shall be active for all drive states; accelerating, constant speed, and decelerating. The drive shall employ PI Regulation for smooth transition.
4. Acceleration/Deceleration: The Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0 seconds to 600 seconds. The drive shall provide a second set of remotely selectable Accel/Decel settings.
5. Speed Regulation: The drive shall be capable of operating in a variety of speed regulation modes, including slip compensation with 0.5% speed regulation.
6. Speed Profiles: The drive shall be capable of producing speed profiles with linear acceleration/ deceleration or 'S-Curve' profiles that provide changing Accel/Decel rates. S-Curve profiles shall be selectable for fixed or adjustable values.
7. Adjustments: The digital interface shall be used for all set-up, operation, and adjustment settings. All adjustments shall be stored in non-volatile memory for factory default values as well as a programmable set of user defaults.

8. Auto Commissioning: The drive shall be capable of automatically determining the motor's stator resistance by outputting both an AC and DC voltage to the motor and monitoring motor current. Stator resistance shall be stored in drive memory for determining proper voltage and current requirements.
9. IR Compensation (DC Boost): The drive shall provide a selectable range for offsetting motor losses at low frequency operation DC Boost shall be current regulated and shall automatically adjust, on each start, to load changes. DC Boost shall be programmable from 15% to 120% of drive rated current.
10. Fault Reset/Run: The drive shall provide up to four automatic fault reset and restarts following a fault condition before locking out and requiring manual restart.
11. Skip Frequencies: The drive shall provide three adjustable setpoints to lock out continuous operation at frequencies which may product mechanical resonance. The setpoints shall have an adjustable bandwidth of 0 Hz to 60 Hz.
12. Run On Power Up: The drive shall provide for automatic restart of equipment after restoration of power after an outage.
13. Fault Memory: The drive shall provide a means to store the last four faults as well as operating frequency, drive status, and power mode at time of fault. Information shall be maintained in the event of power loss.
14. Overload Protection: The drive shall provide NEC motor overload protection testing in accordance with UL Standard 991.
15. Terminal Blocks: The drive shall provide separate terminal blocks for control and power wiring.
16. Operator's Devices: The drive shall be provided with the following door mounted pilot devices in addition to the door mounted Human Interface Module:
 - a. Hand/Off/Auto selector switch
 - b. Run pilot light
 - c. Fault pilot light
 - d. Speed potentiometer for Hand mode
17. Control Inputs: The drive shall provide a separate control input terminal block for customer wiring to remote start, stop, auxiliary, remote speed reference access and enable inputs. Four additional inputs shall be provided as programmable for functions such as preset speed access, job, second Accel and Decel time access and local control selection. Inputs shall be programmable to configure the drive for standard 3 wire, 2 wire, EC and serial operation requirements.
18. Ride Through: The drive shall be capable of control logic ride through in the event of power outages up to 2 seconds in duration.
19. Loss of Reference: In the event of loss of the 4 mA to 20 mA reference signal, the drive shall be user programmable to the following:
 - a. Fault and stop
 - b. Alarm and maintain last reference (within 10%)
 - c. Alarm and got to preset speed
 - d. Alarm and go to minimum speed
 - e. Alarm and go to maximum speed.
20. Analog Output: The drive shall supply two analog outputs selectable 0 volt DC to 10 volt DC or 0 mA to 20 mA which shall be user programmable such that is

- proportional to output frequency, output current, bus voltage or output power, KW, output volts, or output current.
21. Digital I/O: The drive contact output ratings shall be 115-volt AC / 30-volt DC, 5.0 amps resistive, 2.0 amp inductive. The three contacts provided shall be as follows
 - a. Form C Fault Contact
 - b. Two programmable Form A contacts.
 22. Reference Signals:
 - a. Digital: The drive shall be capable of operating from a pulse input with programmable Phase Lock Loop for input/output synchronization.
 - b. Analog: The drive shall be capable of operating from the following speed reference signals:
 - 1) VFD Human Interface Module (Hand)
 - 2) 4 mA to 20 mA signal (Auto)
 - 3) Internal set-point controller with 4-20mA process variable input signal from external transducer.
 23. Internal pump Controller Capability: In addition to ability to follow an analog input related for speed control the drive shall be able to operate in the following control modes:
 - a. Simplex controller: The drive shall Accept a 4-20ma input proportional to the process variable (flow, pressure, or as indicated in other section of the plans and specifications). The drive shall accept direct keypad entry or analog input entry of desired setpoint. The Drive shall utilize PI setpoint control to continuously modulate output speed to maintain setpoint.
 - b. Multi-plex controller: The drive shall be capable of being operated as a multiplex controller operating as in simplex mode with same system inputs but provide lead-lag control of up to 6 pumps such that setpoint is controlled via operation of one or more pumps while alternating pumps to evenly distribute operation time.
 - c. Digital inputs shall be programmable to include the following functions and digital display shall indicate the following condition status using the following English messages:
 - 1) Check Valve input alarm/fault
 - 2) High or low level Alarm/fault
 - 3) High or Low input pressure Alarm/fault
 - 4) High pressure alarm/fault
 - 5) External Fault
 - 6) Pump precharge
 - d. Analog inputs shall be programmable to include the following functions and digital display shall indicate the following condition status using the following English messages:
 - 1) Process variable input (pressure, flow, level, or other).
 - 2) Setpoint
 - 3) Speed referenece

24. The following pump specific control and protective features shall be provided. Protective features shall provide English language display on drive digital display when active:
 - a. Loss of prime protection
 - b. Over Cycling protection
 - c. No flow detection
 - d. Thrust bearing start
 - e. Low input pressure
 - f. Low/high flow level
 - g. Anti Jam protection
 - h. De-scale operation
 25. In addition to the above functionality, provide control, power, and logic functionality as shown in applicable project drawings.
- F. Acceptable manufacturer for the variable frequency drive units is Yaskawa IQ Pump by ICON Technologies, no equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which variable frequency drives are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DRIVES

- A. General: Install variable frequency drives where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that system complies with requirements and services intended purposes.
- B. Access: Provide access space around drives for service as indicated, but in no case less than that recommended by the manufacturer.
- C. Contractor to include up to 1 day for owner training, and two (2) days for startup. Startup to be conducted by Factory Authorized startup personnel.

END OF SECTION 16775

SECTION 16780

REDUCED VOLTAGE SOFT STARTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of reduced voltage soft starters work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. All Reduced Voltage Soft Starters (RVSS or Starter) shall be provided with the complete control and protective functions listed in part 2 of this specification.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's RVSS specifications and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- C. Maintenance Data: Submit Operation and Maintenance Manual and parts lists as specified.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. Handle RVSS and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged starters or components; replace with new.
- B. Store starters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's installation instructions for unloading starters and moving them to final location.

1.5 WARRANTY

- A. All units shall be warranted for a period of twelve (12) months from the date of Engineer's acceptance and beneficial use of the system by the Owner. Any warranty expense during that time shall be born entirely by the manufacturer, including any travel costs or living expenses necessary to repair in warranty equipment.

PART 2 - PRODUCTS

2.1 REDUCED VOLTAGE SOFT STARTER:

- A. The soft starter shall be controlled by microprocessor, for use with three-phase AC induction motors with built-in bypass.
- B. The RVSS shall include all internal auxiliaries required to meet the functional specifications.
- C. The RVSS shall have the following standard performance features:
 - 1. Soft Start with standard voltage ramp
 - 2. Soft Start with pump control curves
 - 3. Soft Start with torque control curve
 - 4. Soft Start with current control curve
 - 5. Soft Start with torque boost (kick start)
 - 6. Linear Acceleration (with user supplied tach.)
 - 7. Soft Stop with standard voltage ramp
 - 8. Soft Stop with pump control curves
 - 9. Final torque setting for pump control curves
 - 10. Soft Stop with torque control
 - 11. Coast to stop
 - 12. Current limit
 - 13. Initial voltage
 - 14. Dual Adjustment (Dual ramp starting & stopping)
 - 15. Generator Mode starting
 - 16. Slow speed and slow speed reverse
 - 17. Software lock of parameters for preventing undesired modifications.
 - 18. The RVSS shall be provided with Modbus RTU serial communications as a standard.
 - 19. Starters located outdoors shall be provided in a NEMA 4X (Marine grade aluminum, powder coated white) enclosure. Starters located indoors shall be provided in a Type 4 enclosure.
 - 20. Operator's Devices: The RVSS shall be provided with the following door mounted pilot devices in addition to the door mounted Human Interface Module:
 - a. Hand/Off/Auto selector switch
 - b. Power On light
 - c. Run pilot light
 - d. Fault pilot light

- e. Reset Pushbutton
 - f. Analog Ammeter
- D. The soft starter should have the following motor protection features as standard.
 - 1. Programmable maximum starts and start inhibit period
 - 2. Stall Detection
 - 3. Electronic shear pin (instantaneous trip and programmable with time delay) during start and run
 - 4. Electronic overload with selectable curves according to IEC and NEMA
 - 5. Under current
 - 6. Phase loss
 - 7. Phase sequence
 - 8. Under voltage
 - 9. Over voltage
 - 10. Load loss
 - 11. Shorted SCR
 - 12. Over temperature
 - 13. External fault
- E. Acceptable manufacturer for the reduced voltage soft start units is Solcon by ICON Technologies, no equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which starters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF RVSS

- A. General: Install starters where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that system complies with requirements and services intended purposes.
- B. Access: Provide access space around starters for service as indicated, but in no case less than that recommended by the manufacturer.
- C. Contractor to include up to 1 day for owner training, and two (2) days for startup. Startup to be conducted by Factory Authorized startup personnel.

END OF SECTION 16780

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APPENDIX



UNIVERSAL ENGINEERING SCIENCES

Consultants In: Geotechnical Engineering • Environmental Sciences
Geophysical Services • Construction Materials Testing • Threshold Inspection
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LOCATIONS:

- Atlanta
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- Ocala
- Orlando (Headquarters)
- Palm Coast
- Panama City
- Pensacola
- Rockledge
- Sarasota
- St. Petersburg
- Tampa
- Tifton
- West Palm Beach

June 29, 2018

Infrastructure Solution Services
7319 Merchant Court, Suite B
Jacksonville, Florida 32202

Attention: Mr. Wade Cobb

Reference: Geotechnical Exploration
Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, Pasco County, Florida
UES Project No. 0830.1800107
UES Report No. 1582753

Dear Mr. Cobb:

Universal Engineering Sciences, Inc. (UES) has completed a geotechnical exploration on the above-referenced site in Dade City, Pasco County, Florida. Our scope of services was in general accordance with UES Proposal 0830.0518.00013, dated May 22, 2018, and authorized on May 29, 2018.

This report contains the results of our study, engineering interpretation, geotechnical design recommendations, and general construction and site preparation considerations.

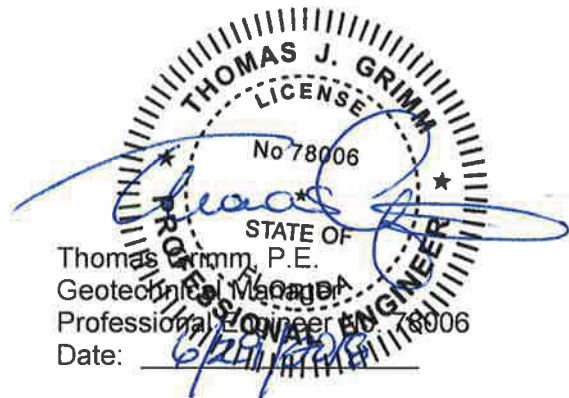
We appreciate the opportunity to have worked with you on this project. Please do not hesitate to contact us if you should have any questions, or if we may further assist you as your plans proceed.

Respectfully submitted,

UNIVERSAL ENGINEERING SCIENCES, INC.

Certificate of Authorization No. 549

Dušan Jovanović
Senior Project Manager





UNIVERSAL ENGINEERING SCIENCES

GEOTECHNICAL EXPLORATION Proposed Dade City Elevated Water Tank and Well Project

Dade City, Pasco County, Florida

UES Project No. 0830.1800107

PREPARED FOR:

Infrastructure Solution Services
7319 Merchant Court, Suite B
Jacksonville, Florida 32202

PREPARED BY:

Universal Engineering Sciences
9802 Palm River Road
Tampa, Florida 33619
(813) 740-8506

June 29, 2018

Consultants in: Geotechnical Engineering • Environmental Sciences • Construction Materials Testing • Threshold Inspection
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1.0 INTRODUCTION

1.1 GENERAL

Universal Engineering Sciences (UES) has completed this report of geotechnical exploration. The following presents the results of our geotechnical exploration of the proposed Dade City Elevated Water Tank and Well Project, located on a parcel of undeveloped land at the east side of Skyline Drive, approximately 200 feet north of Jefferson Avenue, in Dade City, Pasco County, Florida. This report contains the results of our study, engineering interpretation, and our recommendations for geotechnical design and general site preparation. Our scope of services was in general accordance with UES Proposal # 0830.0518.00013 dated May 22, 2018, and authorized on May 25, 2018.

1.2 PROJECT DESCRIPTION

We understand that the project consists of the design and construction of a proposed municipal potable-water, water tank and well. The water tank will consist of a 500,000 gallon, elevated carbon steel tank with an overflow elevation of approximately 100 feet above ground surface. The base diameter of the tank is planned to be 23.5 feet in diameter. The water well completion is unknown at this time and will be developed based on the findings of this exploration. A temporary or test water well was constructed to a depth of 300 feet. Ancillary work associated with the project includes utility pipe trenching, pavement and earth-supported concrete slabs. We were provided with a copy of the planned site layout and boring locations staked in the field by surveyors were used in planning our exploration.

The anticipated structural loads for the water tank include estimated vertical loads of approximately 4,600 kips and horizontal loads at top of foundation of approximately 56 kips.

We have developed geotechnical recommendations that are based upon the above considerations. If any of this information is incorrect, or if you anticipate any changes, please inform us immediately. UES will review changes and reconsider our recommendations, and make revisions as needed.

A general location map of the project area appears in Appendix A: Site Location Map. Also included in Appendix A for your reference are a Site Aerial Photograph, USGS Site Topographic Map and Soil Survey Map.

2.0 PURPOSE AND METHODOLOGIES

2.1 PURPOSE

The purpose of our services was:

- to explore the general subsurface conditions at the site using Standard Penetration Test (SPT) borings, rotary borings, and auger borings;
- to interpret and review the subsurface conditions with respect to the proposed construction as it was described to us; and



- to provide geotechnical engineering design information and recommendations, and general recommendations for site preparation.

This report presents an evaluation of site conditions on the basis of traditional geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards.

2.2 FIELD EXPLORATION

The subsurface conditions across the site were explored with a total of twelve (12) borings. One boring was completed as a temporary water well.

In the proposed water tank, One (1) SPT boring was advanced to a depth of 80 feet near the center of the tank base and three (3) borings were advanced to a depth of 20 feet at the perimeter of the tank base. The perimeter tank borings were located at 120° apart along the base circle diameter. Two (2) SPT borings were advanced to depths of 20 feet within other ancillary improvement areas. The SPT borings were advanced using the rotary wash method, and samples were collected while performing the SPT at regular intervals.

In the proposed pavement areas, five (5) auger borings were advanced, each to a depth of 5 feet. Soil samples were collected from the auger cuttings wherever a visible change in stratigraphy was apparent.

Within 50 feet of the planned potable water well, a test well was installed to a depth of 300 feet. The test well was installed with a 4-inch diameter casing grouted in place to a depth of 100 feet. The well was drilled from 100 to 300 feet with a 3-inch diameter bit. The well was pumped with a submersible pump installed to a depth of 147 feet for a period of approximately 5 hours when the developed water appear clear and free of sediment. A water sample was collected by Dade City personnel for laboratory water quality testing. The test well was left in-place and completed at the surface for future sampling as needed. The well from 100 to 300 feet remained in an open hole condition, caving in the open hole portion of the well and sediment development in the bottom should be anticipated. The surface completion consisted of a stickup, steel well cover cemented in place and a locking cap. Based on the necessary clearing and planned construction on the site, the well should be protected at the surface with steel and concrete bollards or similar obstructions until the test well is abandoned.

The SPT's were performed in general accordance with ASTM D1586 guidelines. However, at depths of 10 feet or less we sampled continuously in order to detect slight variations in the soil profile. In general, a standard split-barrel sampler (split-spoon) is driven into the soil using a 140-pound hammer free-falling 30 inches. The number of hammer blows required to drive the sampler 12 inches, after first seating it 6 inches, is designated the penetration resistance, or SPT-N value. This value is used as an index to soil strength and consistency. The top 4.5 feet of all the building SPT borings were advanced using a hand auger. This technique is a part of our safety procedure due to proximity of underground utility lines that may not have been located by One-Call Sunshine.



Consider the indicated locations, elevations and depths to be approximate. Our drilling crew located the borings based staked locations provided by Infrastructure Solutions Services. The boring locations remained staked at the completion of drilling. The Boring Location Plan is presented in Appendix B.

Unless other arrangements are agreed upon in writing, UES will store recovered soil samples for no more than 60 calendar days from the date of the report. After that date, UES will dispose of all samples.

2.3 LABORATORY TESTING

The soil samples recovered from the test borings were returned to our laboratory and visually classified by our technical staff. In order to further classify the soils at the site, we selected representative samples from our soil borings for laboratory analyses. UES performed two (2) Moisture Content (ASTM D2216), two (2) Percent Passing No. 200 (ASTM D1140), and two (2) Atterberg Limits tests (ASTM D4318).

The laboratory test results are presented on the Boring Logs in Appendix B, next to the soil samples tested.

3.0 FINDINGS

3.1 SURFACE CONDITIONS

At the start of our geotechnical exploration, we reviewed aerial photographs, United States Geologic Survey (USGS) topographic quadrangle maps, and the United States Department of Agriculture Natural Resource Conservation Service (USDA NRCS) Soil Survey of Pasco County for relevant information about the site. According to USGS topographic information, the approximate elevation across the site ranges from 190 to 200 feet NGVD. The site is undeveloped and mostly wooded.

3.2 SUBSURFACE CONDITIONS

3.2.1 SOIL SURVEY

According to soil survey, there is one native, surficial soil groups underlying this site. A summary of selected properties for the identified soil groups on the site is included below in Table 1. The location of these groups can be observed on the Soil Survey Map provided in the Appendix A.



TABLE 1 SUMMARY OF SOIL INFORMATION						
Soil Map Unit & Name	Hydrologic Soil Group	Water Table Type	SHWT Depth	Shrink-Swell Potential	Corrosion Risk	
					Steel	Concrete
45– Kendrick fine sand, 0 to 5 percent slopes	A	--	>6'	Low	Moderate	High

The near subsurface conditions encountered in the borings were consistent with the soils described in the soil survey.

3.2.2 SOIL BORINGS

The boring locations and detailed subsurface conditions are illustrated in Appendix B: Boring Location Plan and Boring Logs. The classifications and descriptions shown on the logs are based upon visual characterizations of the recovered soil samples. Refer to Appendix B: Soils Classification Chart, for further explanation of the symbols and placement of data on the Boring Logs. The general subsurface soil profile on the site, based on the soil boring information, is described below. For more detailed information, please refer to the boring logs.

The subsurface conditions encountered in the borings typically consisted of sands with varying quantities of silts and clays. In borings B-1 and B-5, the sands were encountered to the 20-foot termination depths or a depth of 55 feet, where a soft, weathered limestone with clay and sand infill was encountered. In boring B-5, a harder, less weathered limestone was encountered to the 300-foot termination depth. The sand soils were typically loose to medium dense, moist to wet, and contained 24 to 31 percent fines or soil passing the No. 200 sieve. Soils from approximately 10 feet to the limestone interface were wet and typically medium strength with N-values ranging from 14 to 35. The Table 2 presented below summarizes the recommended soil parameters beneath the proposed tank foundation.

Boring B-5 was cased to a depth of 100 feet and drilled to a total depth of 300 feet and completed as a temporary test well.

Within the proposed pavement areas boring A-1 through A-4 were advanced. The subsurface conditions typically consisted of poorly graded sands and sands with clay to the 5-foot termination depth. The pavement subgrade materials were generally considered fair quality for paved area.

The shallow water table was encountered at depths of greater than 10 feet below existing grade. Due to the mud-rotary drilling methods used, shallow groundwater depths were difficult to accurately measure beyond 10 feet. However, we estimate groundwater depths should be estimated at a depth of 10 feet based on near bodies of water and site elevations.

In boring B-5, ground water depths beneath the confining layer were observed. The confining layer was observed from a depth of 55 feet to an approximate depth of 110 feet. Groundwater



was observed at a depth of 125 feet, beneath the confining layer. This estimated groundwater levels are subject to fluctuation.

The boring logs and related information included in this report are indicators of subsurface conditions only at the specific locations and times noted. Subsurface conditions, including groundwater levels and the presence of deleterious materials, at other locations on the site may differ significantly from conditions which, in the opinion of UES, exist at the sampling locations. Note, too, that the passage of time may affect conditions at the sampling locations.

4.0 RECOMMENDATIONS

4.1 GENERAL

In this section of the report we present our geotechnical and site preparation recommendations and information pertaining to the construction related services UES can provide. Our recommendations are made based upon a review of the attached soil test data, our understanding of the proposed construction as it was described to us, and our stated assumptions. If the structural loads or site layout differ from those assumed or described to us, we should be retained to review the new or updated information and amend our recommendations with respect to those changes. Additionally, if subsurface conditions are encountered during construction that were not encountered in the test borings, report those conditions immediately to us for observation and recommendations.

4.2 GROUNDWATER

Based upon our visual inspection of the recovered soil samples, review of information obtained from Southwest Water Management District (SWFWMD) and the Soil Survey of Pasco County, and our knowledge of local and regional hydrogeology, we estimate that the seasonal high groundwater table (SHWT) is approximately 10 feet below the existing grade at the boring locations.

It should be noted that the estimated SHWT does not provide any assurance that groundwater levels will not exceed this level in the future. Should impediments to surface water drainage exist on the site, or should rainfall intensity and duration exceed the normally anticipated amounts, groundwater levels may exceed our seasonal high estimate. Also, future development around the site could alter surface runoff and drainage characteristics, and cause our seasonal high estimate to be exceeded. We therefore recommend positive drainage be established and maintained on the site during construction. Further, we recommend permanent measures be constructed to maintain positive drainage from the site throughout the life of the project. Finally, we recommend all foundation and pavement grades account for the seasonal high groundwater conditions.

Temporary dewatering may be required for some parts of this site if construction proceeds during the wet season, particularly if deep excavations are necessary or if pumping of the surficial materials is experienced during earthworking operations. Where they were encountered, sands with silts (SP-SM), silty fine sands (SM), and clayey sands (SC) near the surface may be prone to pumping in response to normal construction vehicular traffic and earthworking operations. Therefore, we recommend that the contract documents provide for determining the depth to the groundwater table just prior to construction, and for any required



remedial dewatering. Further, we recommend that the groundwater table be maintained at least 24 inches below all earthwork and compaction surfaces.

4.3 WATER TANK FOUNDATION

4.3.1 GENERAL

Foundation subgrades encountered at the SPT boring locations within the water tank footprint are considered suitable for support of the proposed loading conditions using conventional shallow foundations provided additional subgrade improvement is performed.

Foundation subgrades from the bottom of foundations to a depth of 3 feet below the bottom of foundations should be excavated and replaced by compacted structural fill.

If the actual structural loads will exceed those we have previously stated, our foundation recommendations presented herein may not be applicable, and UES should be retained to review the updated information and revise our recommendations as needed.

4.3.2 BEARING PRESSURE – SPREAD-FOOTING FOUNDATIONS

Provided foundation subgrades are prepared as recommended, we recommend using shallow spread foundation sized to exert a maximum bearing pressure of 3,000 pounds per square foot (psf). The following summarizes tank ring foundations design parameters.

TABLE 2						
SUMMARY OF SOIL/LIMESTONE DESIGN PARAMETERS						
Soil/limestone Depth	Approximate Interval (ft)*	Eff. Unit Weight (pcf)	C, psf	ϕ, °	Passive Pressure (K)	Natural Moisture
Sand (SP) Compacted Structural Fill	4 to 7	110	0	36	3.85	15 %
Sand (SM)	7 to 55	48	0	32	3.25	Sat.
Limestone	55 to 110	130	1000	30	--	Sat.

*Depths from top of boring elevations.

4.3.2.1 BEARING MATERIAL

The foundation subgrades should be excavated to a depth of 3 feet below the bottom of foundation and replaced with a suitable structural fill. Structural fill should consist of clean sand (SP) with no more than 12 percent fines (passing No. 200 sieve). The fill should be compacted to at least 98% of the Modified Proctor maximum dry density (MPMDD) (ASTM D 1557). The compacted soils dry density should be verified at 1-foot intervals below the bottom of foundation prior to placing foundation concrete.



4.3.2.2 FOOTING SIZE AND BEARING DEPTH

The tank foundations should be designed for construction to depths and widths as recommended by tank designers (Caldwell Tanks), even if the maximum allowable soil bearing pressure is not be developed.

4.3.2.3 ESTIMATED SETTLEMENT

For the planned ring foundation designed and constructed as recommended, we estimate total foundation settlement of less than 1-1/2 inch, and differential settlement of less than 1/3 inch across the 23.5-foot diameter tank base. If the site is not prepared according to the guidelines provided later in this report, our estimates of total and differential settlement may be exceeded during the design life of the structure.

During initial filling of the water tank, we recommend the water tank be filled incrementally such as 1/4 or 1/3 the total volume. Following each incremental filling the tank should be monitored over a 24-hour period for settlement at four locations at the base of the tank. The tank base should be evaluated for total and differential movement during the initial filling.

4.3.2.4 SEISMIC CONSIDERATION

With regard to seismic considerations, UES reviewed the Florida Building Code (FBC) which has jurisdiction in the State of Florida. Since seismic design is not part of the FBC, we consulted the only available recognized source of seismic information, the International Building Code 2006 (Section 1613). Per Table 1613.5.2 we recommend a Site Class of E for this project site. Although the groundwater is less than 40 feet below grade, due to overall fines content of the soils and the minimal expected ground accelerations per figures 1613.5(1) and (2), it is our opinion that the liquefaction potential of the site is minimal.

4.4 EARTH-SUPPORTED FLOOR SLAB

For the earth-supported concrete slabs, we recommend using a standard concrete slab-on-grade system. A fibermesh mix or welded wire mesh could be used for reducing the development of cracks. If welded wire is used, we recommend using flat wire instead of rolled. Normal weight concrete having a 28-day compressive strength (f'c) of at least 2500 psi should be used. A modulus of subgrade reaction of 150 pci can be used beneath the proposed floor slab, assuming the slab is supported on compacted structural fill or well compacted existing subgrade soils (minimum 98% MPMDD).

4.4.1 FLOOR SLAB MOISTURE CONTROL

Per the Florida Building Code, we recommend installing polyethylene vapor barrier between the bottom of the floor slab and the top of the compacted subgrade. We recommend installing a minimum 10-mil, polyethylene vapor barrier between the bottom of the floor slab and the top of the compacted subgrade. This will help to minimize floor dampness and moisture intrusion into the structure through the slab. Assume a coefficient of friction of 0.2 at the soil-slab interface if a vapor barrier is used. If no vapor barrier is used, assume a coefficient of friction of 0.35 at the interface.



4.5 PAVEMENT SECTIONS

4.5.1 ASSUMPTIONS

We assume that a combination of flexible asphaltic and rigid concrete pavement sections will be used on this project. Our recommendations for both pavement types are listed in the following sections.

At the time of this exploration, specific traffic loading information was not provided to us. We have assumed the following conditions for our recommended minimum pavement design.

- the subgrade soils are prepared as described in Site Preparation section of this report
- resilient modulus of 7,500 psi (LBR = 20)
- a twenty (20) year design life
- terminal serviceability index (P_t) of 2.5
- reliability of 85 percent
- total equivalent 18 kip single axle loads ($E_{18}SAL$) up to 35,000 for light duty pavements - car and pickup truck traffic
- total equivalent 18 kip single axle loads ($E_{18}SAL$) up to 150,000 for heavy duty pavements – occasional heavy truck traffic (delivery, trash collection, service lanes, etc)

4.5.2 LAYER COMPONENTS

For preliminary pavement designs, we recommend using a three-layer pavement section Based on the results of our soil borings, the assumed traffic loading information and review of the 2008 FDOT Flexible Pavement Design Manual, our minimum recommended pavement component thicknesses are presented in Table 3 below.

Light-duty: auto parking areas; over eighty cars; light panel and pickup trucks; average gross weight of 4,000 pounds, total equivalent 18-kip single axle loads (ESALs) equals 30,000

Heavy-duty: commercial driveways, small roadways; twenty trucks or less per day; average gross vehicle weight of 25,000 pounds, total ESALs equals 150,000

TABLE 3 MINIMUM ASPHALTIC PAVEMENT COMPONENT THICKNESSES				
Service Level	Maximum Traffic Loading	Layer Component		
		Surface Course (inches)	Base Course (inches)	Stabilized Subgrade (inches)
Light Duty	up to 35,000 $E_{18}SAL$	1½	6	12
Heavy Duty	up to 150,000 $E_{18}SAL$	2	8	12



4.5.3 STABILIZED SUBGRADE

We recommend that the stabilized subgrade materials immediately beneath the base course exhibit a minimum Limerock Bearing Ratio (LBR) of 40 as specified by FDOT, or a minimum Florida Bearing Value (FBV) of 75 psi, compacted to at least 98 percent of the MPMDD value.

Stabilized subgrade can be imported materials or a blend of on-site and imported materials. If a blend is proposed, we recommend that the contractor perform a mix design to find the optimum mix proportions.

Compaction testing of the stabilized subgrade should be performed to full depth at a frequency of at least one (1) test per 10,000 square feet, or a minimum of 3 tests, whichever is greater.

4.5.4 BASE COURSE

We recommend using either limerock or a crushed concrete base course material. The base utilized should have a minimum LBR of 100, and should meet current FDOT requirements for graded aggregate base. Place the base in maximum 6-inch lifts and compact each lift to a minimum density of 98 percent of the MPMDD.

Perform compliance base density testing to a depth of 1-foot at a frequency of one test per 10,000 square feet, or at a minimum of two test locations, whichever is greater.

If limerock base material is to be used, adequate separation between groundwater and the base must be maintained. Limerock is highly moisture sensitive and becomes unstable when saturated.

4.5.5 FLEXIBLE SURFACE COURSE

In light duty areas where there is occasional truck traffic, but primarily passenger cars, we recommend that the surfacing consist of FDOT SuperPave (SP) asphaltic concrete. The surface course should consist of FDOT SP-9.5 fine mix for light-duty areas and FDOT SP-12.5 and/or SP-9.5 fine mix for heavy duty areas. The asphaltic concrete should be compacted to an average field density of 93 percent of the laboratory maximum density determined from specific gravity (G_{mm}) methods, with an individual test tolerance of ± 2 percent. Specific requirements for the SuperPave asphaltic concrete structural course are outlined in the latest edition of FDOT, Standard Specifications for Road and Bridge Construction.

After placement and field compaction, the surfacing should be cored to evaluate material thickness and density. Cores should be obtained at frequencies of at least one (1) core per 10,000 square feet of placed pavement or a minimum of two (2) cores per day's production.

4.5.6 RIGID PAVEMENT OPTION

In heavily loaded and/or high traffic areas such as aprons and garbage corrals we recommend using a rigid pavement system for increased strength and durability and for longer life. Portland cement concrete pavement is a rigid system that distributes wheel loads to the subgrade soils over a larger area than a flexible asphalt pavement. This results in reduced localized stress to



the subgrade soil. We recommend using a compacted subgrade below concrete pavement with the following stipulations:

1. Subgrade soils must be densified to at least 98% MPMDD to a depth of at least 1-foot directly below the bottom of concrete slab.
2. The surface of the subgrade soils must be smooth, and any disturbances or wheel rutting corrected prior to placement of concrete.
3. The subgrade soils must be moistened prior to placement of concrete.
4. Concrete pavement thickness should be uniform throughout, with exception to the thickened edges (curb or footing).
5. The bottom of the pavement should be separated from the estimated seasonal high groundwater level by at least 12 inches.

Our recommendations on slab thickness for standard duty concrete pavements are based on (1) the subgrade soils densified to at least 98% MPMDD, (2) modulus of subgrade reaction (k) equal to 150 pci, (3) a 30-year design life, and (4) total ESAL of 45,000. We recommend using the design shown in the table below.

TABLE 4 RIGID PAVEMENT COMPONENT RECOMMENDATIONS - LIGHT DUTY		
Minimum Pavement Thickness	Maximum Control Joint Spacing	Minimum Sawcut Depth
5 Inches	10 Feet x 10 Feet	1.25 Inches

Our recommendations on slab thickness for heavy duty concrete pavements are based on the same factors as above with the exception of the total ESAL increased to 300,000. Our recommended design for heavy duty concrete pavement is shown in table below.

TABLE 5 RIGID PAVEMENT COMPONENT RECOMMENDATIONS - HEAVY DUTY		
Minimum Pavement Thickness	Maximum Control Joint Spacing	Minimum Sawcut Depth
6 Inches	14 Feet x 14 Feet	1.5 Inches

For both standard duty and heavy duty rigid pavement sections, we recommend using normal weight concrete having a 28 day compressive strength (f'_c) of 4,000 psi, and a minimum 28-day flexural strength (modulus of rupture) of at least 600 psi (based on the 3 point flexural test of



concrete beam samples). Layout of the sawcut control joints should form square panels, and the depth of sawcut joints should be at least $\frac{1}{4}$ of the concrete slab thickness.

4.5.7 EFFECTS OF GROUNDWATER

One of the most critical influences on pavement performance in Florida is the relationship between the pavement subgrade and the seasonal high groundwater level.

It has been our experience that many roadways and parking areas have been damaged as a result of deterioration of the base and the base/surface course bond due to moisture intrusion. Regardless of the type of base selected, we recommend that the seasonal high groundwater and the bottom of the base course be separated by at least 24-inches.

At this site pavement constructed on or above existing grade should meet the minimum required separation.

4.5.8 UNDERDRAINS

Underdrains should consist of 6-inch perforated plastic pipe wrapped in a drain sock. The pipe should be surrounded by filter material meeting FDOT requirement Section 902.2. The pipe should be encased within filter material with at least 6 inches below, 6 inches above, and 6 inches around each side. The invert of the drain pipe should be located at least 36 inches below the bottom of the pavement base course. For parallel underdrains, the center to center spacing of the pipes should be no greater than 15 feet.

Additional underdrain action can be achieved by bedding any stormwater pipe trenches with coarse gravel, such as FDOT #57 stone, beneath the pipes for at least 6 inches and for at least 6 inches up the sides of the pipes.

4.5.9 CONSTRUCTION TRAFFIC

Light duty roadways and incomplete pavement sections will not perform satisfactorily under construction traffic loadings. We recommend that construction traffic (construction equipment, concrete trucks, dump trucks, etc.) be re-routed away from these roadways or that the pavement section be designed for these loadings.

4.6 **SITE PREPARATION**

We recommend normal, good-practice site preparation procedures. These procedures include clearing and grubbing the site, proof-rolling and proof-compacting the subgrade, and filling to grade with engineered fill as needed.

A more detailed synopsis of this work is as follows:

1. Strip the proposed construction limits of all existing grass, roots, topsoil, construction debris, and other deleterious materials within and 5 feet beyond the perimeter of the proposed building and in all paved areas. Expect clearing and grubbing to depths of 6 inches, on average. Deeper clearing and grubbing depths may be required where major root systems are encountered.



2. Proof-roll the subgrade with a heavily loaded, rubber-tired vehicle under the observation of a UES geotechnical engineer or his representative. Proof-rolling will help locate any zones of especially loose or soft soils not encountered in the soil test borings. Then undercut, or otherwise treat these zones as recommended by the engineer.
3. Prior to any filling of the site, proof-compact the subgrade from the surface using suitable compaction equipment, until you obtain a minimum density of 95% MPMDD to a depth of 2 feet below stripped grade. In order to achieve the required degree of compaction, the soils may need to be moisture conditioned until the in-situ water content is within +/- 2% of the optimum moisture content (OMC).
4. Test the subgrade for compaction at a frequency of not less than one test per 2,500 square feet per foot of depth improvement in the building areas. In paved areas, perform compliance tests on the stabilized subgrade for full depth at a frequency of one test per 10,000 square feet, or at a minimum of two test locations, whichever is greater.
5. Place fill material, as required. The fill should consist of fine to medium sand with less than 5 percent soil fines. You may use fill materials with soil fines between 5 and 12-percent, but strict moisture control may be required. Place fill in uniform 10 to 12 inch loose lifts and compact each lift to a minimum density of 95% MPMDD at a moisture content of +/- 2% of OMC.
6. Perform compliance tests within the fill at a frequency of not less than one test per 2,500 square feet per lift in the building areas, or at a minimum of two test locations, whichever is greater. In paved areas, perform compliance tests at a frequency of not less than one test per 10,000 square feet per lift, or at a minimum of two test locations, whichever is greater.
7. Test all final footing cuts for compaction to a depth of 2 feet. Additionally, we recommend you test one out of every four column footings, and that you complete at least one test per every 50 lineal feet of wall footing.

Using vibratory compaction equipment at this site may disturb adjacent structures. We recommend you monitor nearby structures before and during proof-compaction. If disturbance is noted, halt vibratory compaction and inform UES immediately. We will review the compaction procedures and evaluate if the compactive effort results in a satisfactory subgrade complying with our original design assumptions.

4.7 CONSTRUCTION RELATED SERVICES

UES operates and maintains an in-house, FDOT certified construction materials testing laboratory. Our technicians are highly trained and experienced, and our engineering staff is already familiar with the details of your project. Therefore, we recommend the owner retain UES to perform construction materials testing and field observations on this project. This includes monitoring all stripping and grading, observation of foundation excavation and construction, verification of pavement subgrade and all other construction testing and inspection services that may be needed on this project.

The geotechnical engineering design does not end with the advertisement of the construction documents. It is an on-going process throughout construction. Because of our familiarity with the site conditions and the intent of the engineering design, our engineers are the most qualified to address problems that might arise during construction in a timely and cost-effective manner.



5.0 LIMITATIONS

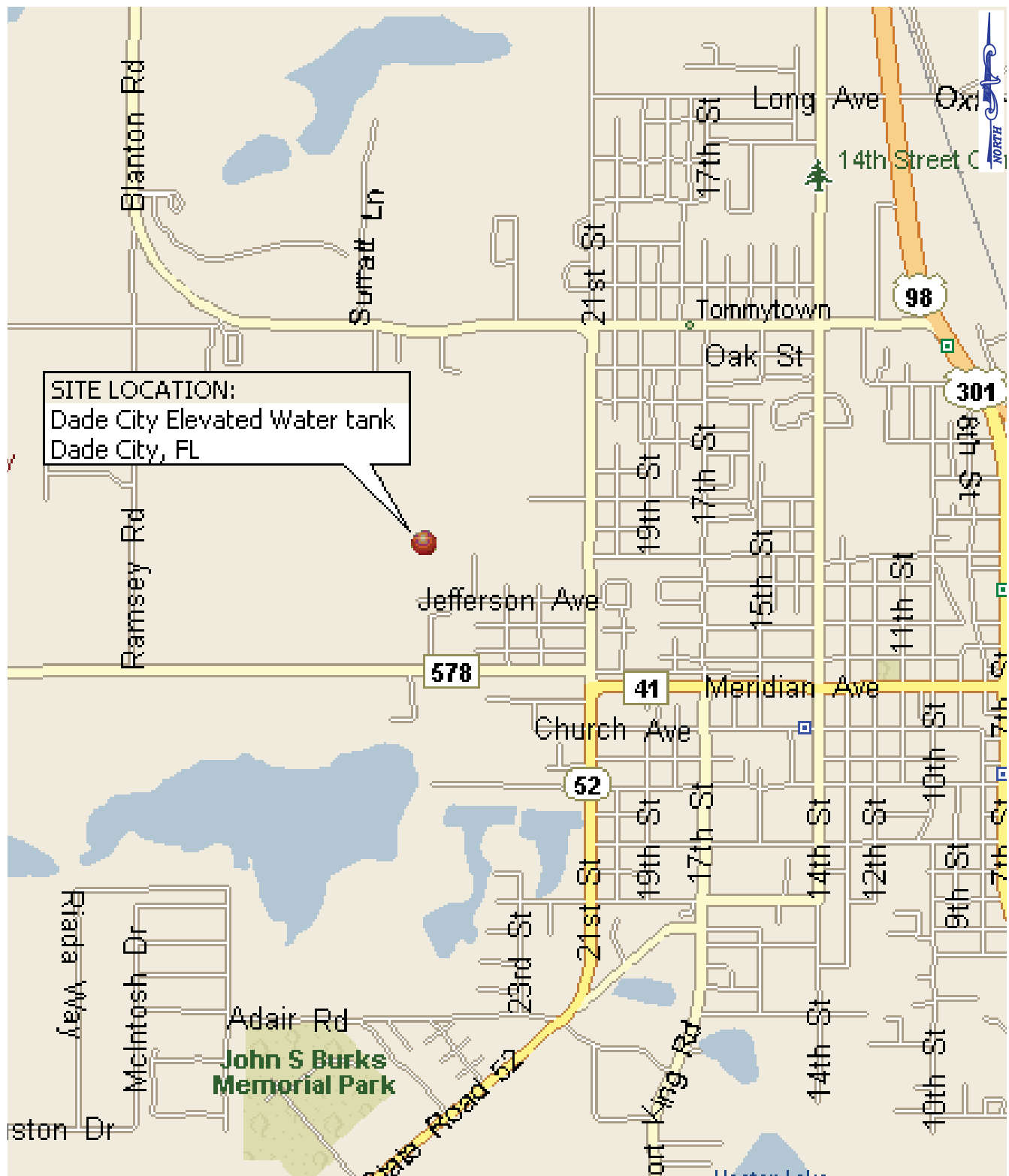
During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible subsurface variations. A Geoprofessional Business Association (GBA) publication, "Important Information About Your Geotechnical Engineering Report" appears in Appendix C, and will help explain the nature of geotechnical issues. Further, we present documents in Appendix C: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

Do not apply any of this report's conclusions or recommendations if the nature, design, or location of the facilities is changed. If changes are contemplated, UES must review them to assess their impact on this report's applicability. Also, note that UES is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of this report's subsurface data or engineering analyses without the express written authorization of UES.

* * * * *



APPENDIX A



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PROPOSED DATE CITY ELEVATED WATER TANK AND WELL PROJECT
SKYLINE DRIVE
DADE CITY, PASCO COUNTY, FLORIDA

SITE LOCATION MAP

CLIENT: INFRASTRUCTURE SOLUTION SERVICES

DRAWN BY: SC

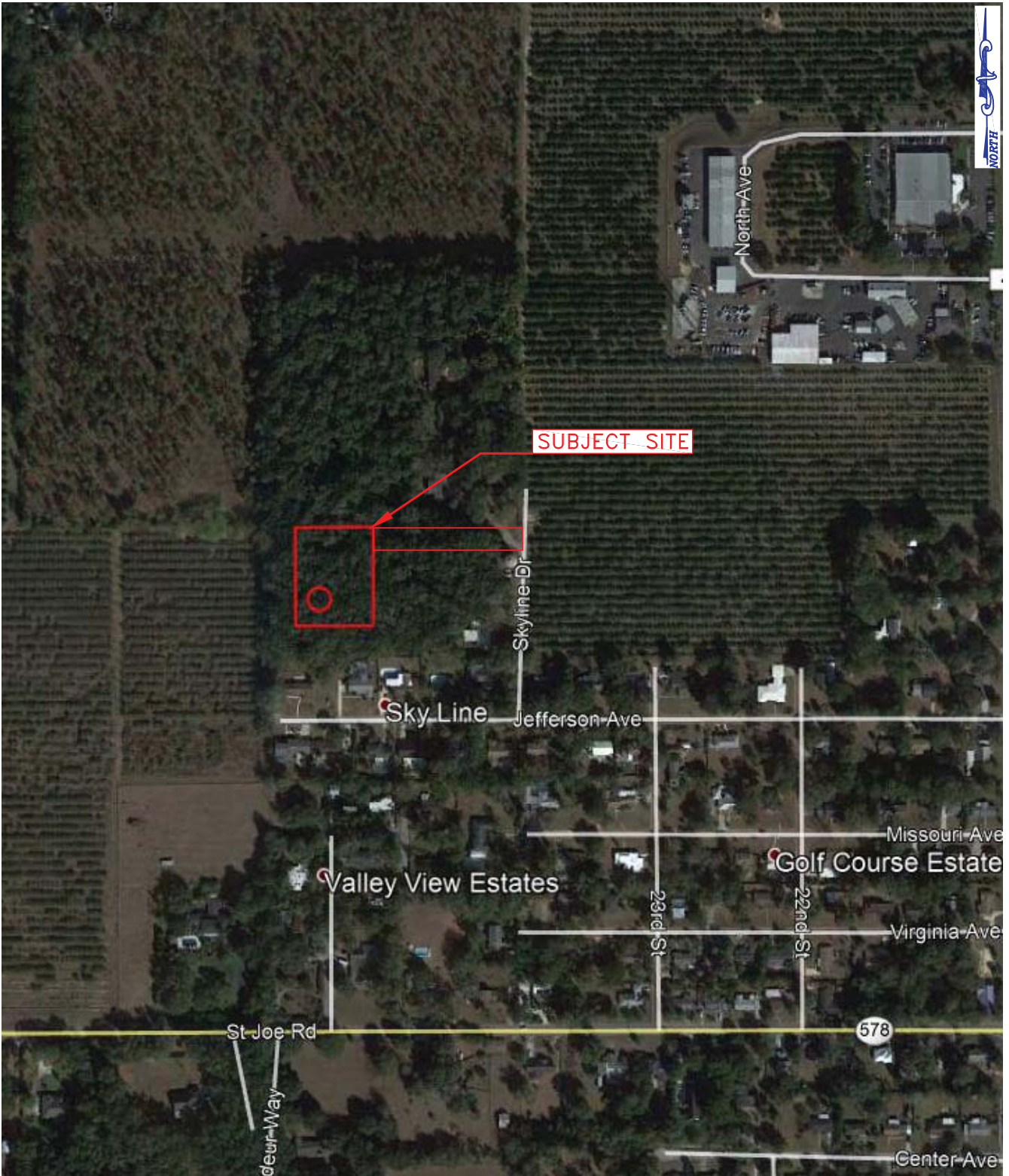
DATE: JUNE 11, 2018

SCALE: NOT TO SCALE

PROJECT NO: 0830.1800107

REVIEWED BY: TG

APPENDIX: A



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PROPOSED DATE CITY ELEVATED WATER TANK AND WELL PROJECT
SKYLINE DRIVE
DADE CITY, PASCO COUNTY, FLORIDA

SITE AERIAL PHOTOGRAPH

CLIENT: INFRASTRUCTURE SOLUTION SERVICES

DRAWN BY: SC

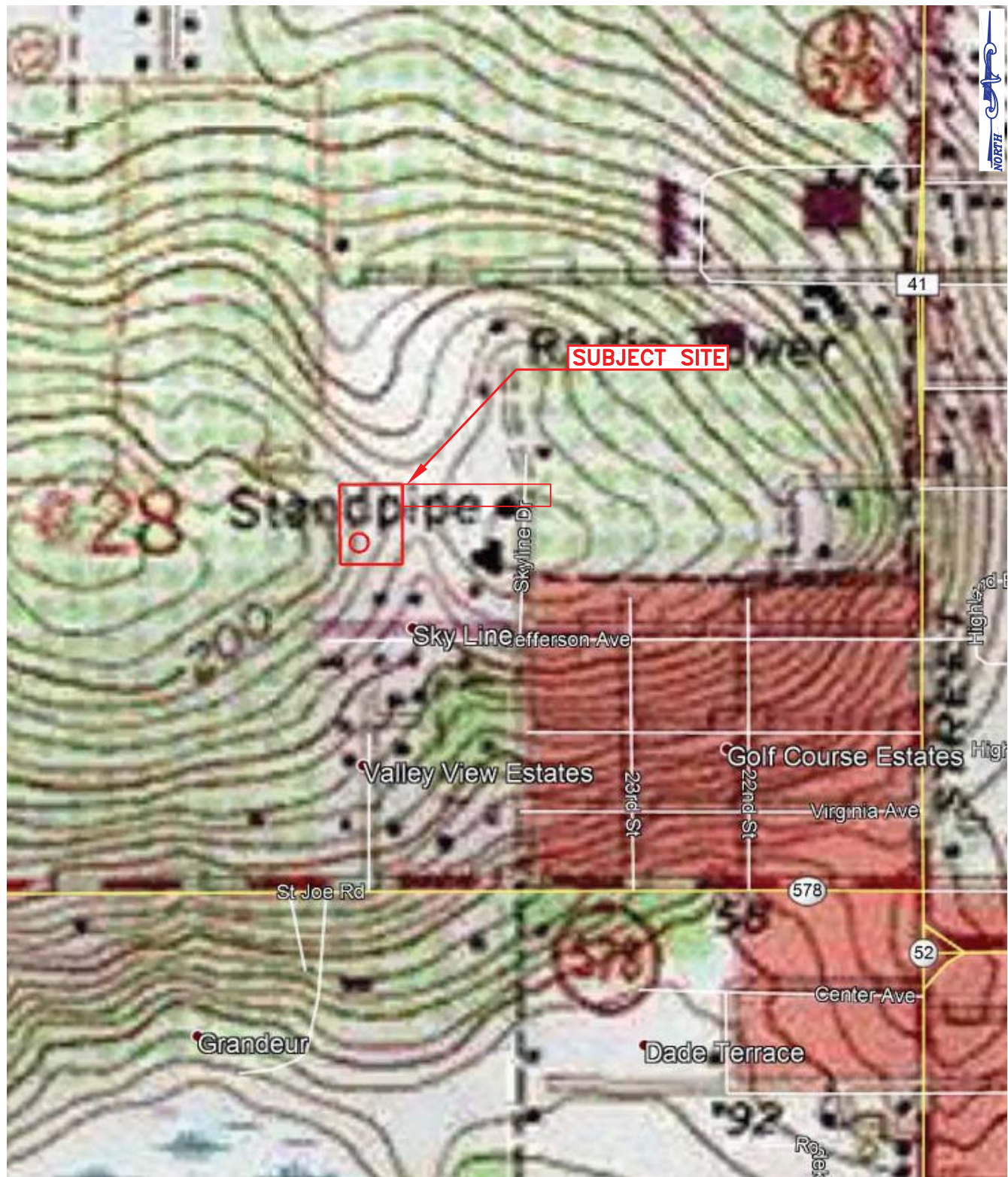
DATE: JUNE 11, 2018

SCALE: NOT TO SCALE

PROJECT NO: 0830.1800107

REVIEWED BY: TG

APPENDIX: A



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PROPOSED DATE CITY ELEVATED WATER TANK AND WELL PROJECT
SKYLINE DRIVE
DADE CITY, PASCO COUNTY, FLORIDA

SITE TOPOGRAPHIC MAP

CLIENT: INFRASTRUCTURE SOLUTION SERVICES	DRAWN BY: SC	DATE: JUNE 11, 2018
SCALE: NOT TO SCALE	PROJECT NO: 0830.1800107	REVIEWED BY: TG
		APPENDIX: A



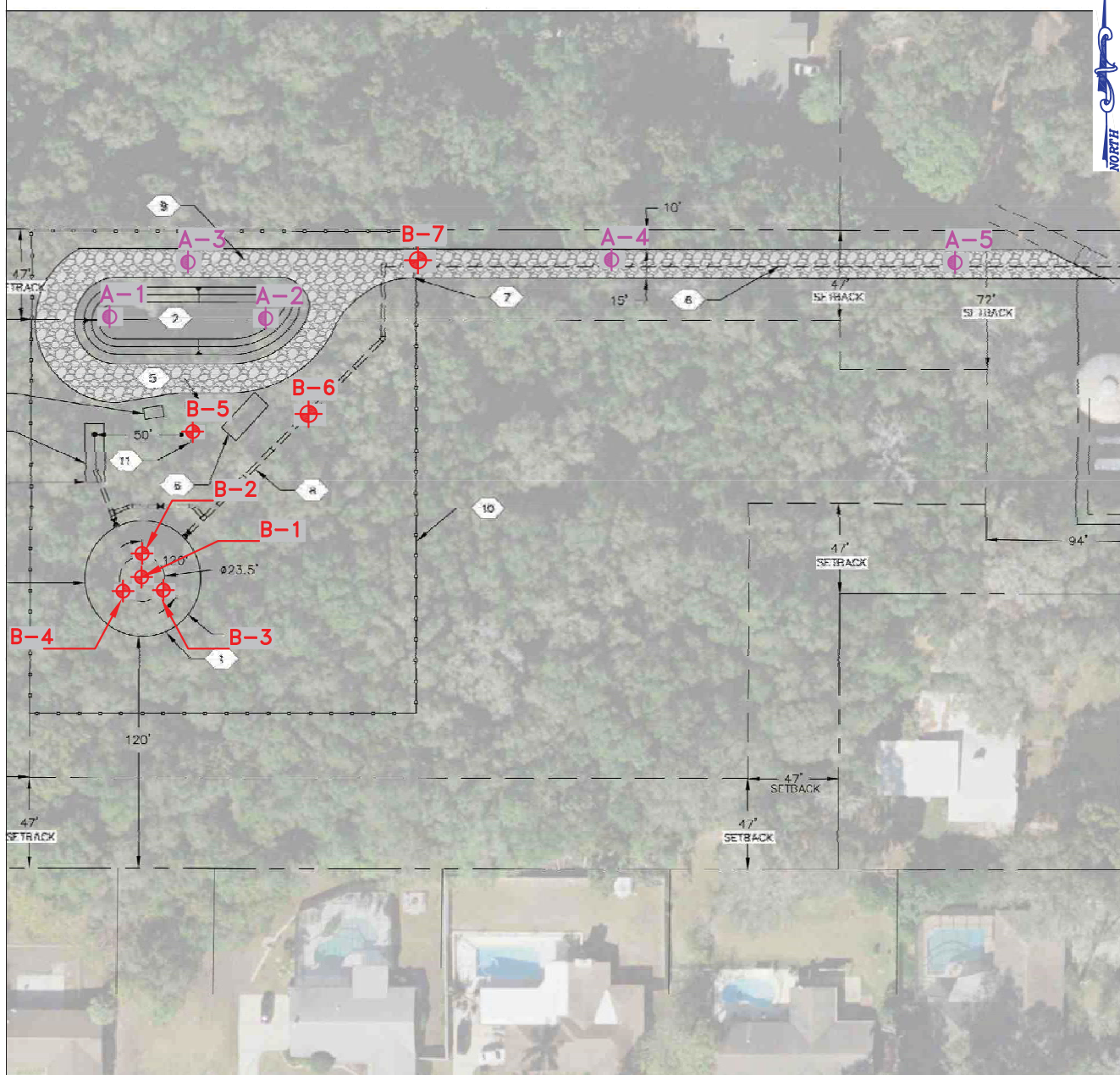
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ENGINEERING SCIENCES

PROPOSED DATE CITY ELEVATED WATER TANK AND WELL PROJECT
SKYLINE DRIVE
DADE CITY, PASCO COUNTY, FLORIDA

SOIL SURVEY MAP

CLIENT: INFRASTRUCTURE SOLUTION SERVICES	DRAWN BY: SC	DATE: JUNE 11, 2018
SCALE: NOT TO SCALE	PROJECT NO: 0830.1800107	REVIEWED BY: TG
		APPENDIX: A

APPENDIX B



LEGEND:

- ⊕ **B-1** Approximate SPT boring location
- ⊕ **A-2** Approximate AUGER boring location



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**PROPOSED DATE CITY ELEVATED WATER TANK AND WELL PROJECT
SKYLINE DRIVE
DADE CITY, PASCO COUNTY, FLORIDA**

BORING LOCATION PLAN

CLIENT: INFRASTRUCTURE SOLUTION SERVICES	DRAWN BY: SC	DATE: JUNE 11, 2018
SCALE: NOT TO SCALE	PROJECT NO: 0830.1800107	REVIEWED BY: TG
		APPENDIX: B



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(813) 740-8506

BORING LOG

PROJECT NO.: 0830.1800107

APPENDIX:

PAGE: 1

PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

A-1
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/11/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >5.0

DATE FINISHED: 6/11/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-11-2018

DRILLED BY: J.H

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: AUGER

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Dark brown sand (SP)						
1															
2															
3									Brown orange sand with clay (SP-SC)						
4															
5									Boring terminated at 5 ft.						



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APPENDIX:

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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

A-2
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/11/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >5.0

DATE FINISHED: 6/11/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-11-2018

DRILLED BY: J.H

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: AUGER

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Dark brown sand (SP)						
1															
2															
3									Brown orange sand with clay (SP-SC)						
4															
5									Boring terminated at 5 ft.						



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PROJECT NO.: 0830.1800107

APPENDIX:

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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

A-3
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/11/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >5.0

DATE FINISHED: 6/11/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-11-2018

DRILLED BY: J.H

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: AUGER

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Dark brown sand (SP)						
1															
2															
3									Brown orange sand with clay (SP-SC)						
4															
5									Boring terminated at 5 ft.						



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APPENDIX:

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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

A-4
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/11/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >5.0

DATE FINISHED: 6/11/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-11-2018

DRILLED BY: J.H

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: AUGER

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Dark brown sand (SP)						
1															
2															
3									Brown orange sand with clay (SP-SC)						
4															
5									Boring terminated at 5 ft.						



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APPENDIX:

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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

A-5
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/11/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >5.0

DATE FINISHED: 6/11/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-11-2018

DRILLED BY: J.H

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: AUGER

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Dark brown sand (SP)						
1															
2									Brown sand (SP)						
3															
4															
5									Boring terminated at 5 ft.						



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PROJECT NO.: 0830.1800107

APPENDIX:

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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

B-1
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/8/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >10.0

DATE FINISHED: 6/8/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-8-2018

DRILLED BY: S.T

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: SPT

ALT UES BORING LOG 1800107 DADE CITY WATER TANK GPJ UES NEW.GDT 6/29/18

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)	G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
										LL	PL	PI	
0							Brown sand (SP)						
5		3-2-2	4				Light brown clayey sand (SC)						
		6-8-6	14				Light brown to orange brown, clayey sand (SC)						
		3-7-9	16					23.4	14.2	30	10	20	
10		8-8-10	18										
15		10-11-13	24										
20		11-18-20	38										
25		11-16-18	34				Tan silty sand (SM)						
30		9-15-15	30										
35		11-17-18	35										
40		8-11-12	23										
45		8-7-10	17										
50		8-9-11	20				Dark brown clayey sand (SC)						
55		6-8-10	18										
60		7-9-10	19				Tan, soft, Limestone with clayey sand infill						
65		6-7-11	18										
70		5-6-7	13										
75		4-6-8	14										
80		4-4-8	12				Boring terminated at 80 ft.						



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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

B-2
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/8/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >10.0

DATE FINISHED: 6/8/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-8-2018

DRILLED BY: S.T

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: SPT

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Dark grayish brown silty sand (SM)						
									Brown sand (SP)						
5									Brown clayey sand (SC)						
		2-3-4	7						Orange cemented sand (SP)						
		9-12-13	25												
		14-12-10	22												
10		8-12-12	24												
									Tan sand with clay (SP-SC)						
15		10-9-12	21												
									Light brown sand with clay (SP-SC)						
20		9-12-13	25												
									Boring terminated at 20 ft.						

ALT UES BORING LOG 1800107 DADE CITY WATER TANK GPJ UES NEW.GDT 6/29/18



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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

B-3
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/8/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >10.0

DATE FINISHED: 6/8/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-8-2018

DRILLED BY: S.T

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: SPT

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Dark brown sand (SP)						
									Brown sand (SP)						
5									Brown clayey sand (SC)						
		2-2-3	5												
		3-3-7	10												
		9-11-12	23						Light brown cemented sand (SP)						
10		11-11-12	23												
15		1-12-12	24												
									Light brown sand (SP)						
20		8-11-11	22						Boring terminated at 20 ft.						

ALT UES BORING LOG 1800107 DADE CITY WATER TANK GPJ UES NEW.GDT 6/29/18



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PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

B-4
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/8/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >10.0

DATE FINISHED: 6/8/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-8-2018

DRILLED BY: S.T

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: SPT

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Brown sand (SP)						
									Brown sand with clay (SP-SC)						
5									Brown and light brown cemented sand (SP)						
		3-5-7	12												
		8-9-11	20												
		9-9-9	18												
10		11-11-8	19												
									Brown clayey sand (SC)						
15		10-12-13	25												
									Light brown cemented sand (SP)						
20		11-12-14	26						Boring terminated at 20 ft.						

ALT UES BORING LOG 1800107 DADE CITY WATER TANK GPJ UES NEW.GDT 6/29/18



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BORING LOG

PROJECT NO.: 0830.1800107

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PAGE: 1

PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

B-5
TOWNSHIP:

SHEET: **1 of 2**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/11/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): 125

DATE FINISHED: 6/14/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6/14/2018

DRILLED BY: Huss

REMARKS: Well installed, 4-inch casing to 100 ft, open hole to 300 ft

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: SPT

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Brown fine sand (SP)						
5									Orange sandy clay (CL)						
10															
15															
20															
25															
30															
35															
40															
45															
50															
55									White clayey limestone						
60															
65															
70															
75															
80															
85															
90															
95															
100															
105															
110									White limestone						
115															
120															
125															
130															
135															
140															
145															
150															

ALT UES BORING LOG 1800107 DADE CITY WATER TANK GPJ UES NEW.GDT 6/29/18



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Tampa, Florida 33619
(813) 740-8506

BORING LOG

PROJECT NO.:	0830.1800107
APPENDIX:	
PAGE:	2

PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION: SECTION:
TOWNSHIP: B-5

SHEET: 2 of 2
RANGE:

ALT UES BORING LOG 1800107 DADE CITY WATER TANK GPJ UES NEW.GDT 6/29/18

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
150															
155															
160															
165															
170															
175															
180															
185															
190															
195															
200															
205															
210															
215															
220															
225															
230															
235															
240															
245															
250															
255															
260															
265															
270															
275															
280															
285															
290															
295															
300									Boring terminated at 300 ft.						



UNIVERSAL ENGINEERING SCIENCES
9802 Palm River Road
Tampa, Florida 33619
(813) 740-8506

BORING LOG

PROJECT NO.: 0830.1800107

APPENDIX:

PAGE: 9

PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION:
SECTION:

B-6
TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

ELEVATION:

DATE STARTED: 6/8/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >10.0

DATE FINISHED: 6/8/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-8-2018

DRILLED BY: P.H

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: SPT

DEPTH (ft)	S A M P L E	Hand Cone Penetrometer (kg/cm ²)	N (bpf)	SPT-N vs DEPTH (bpf)			G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS			ORG (%)
				0	25	50						LL	PL	PI	
0									Brown-orange sand (SP)						
5															
		woh/18"	woh/18"												
		1-1-2	3												
		2-2-2	4												
10		2-2-2	4												
15		5-5-8	13						Brown silty sand (SM)						
20		3-5-5	10						Boring terminated at 20 ft.						

ALT UES BORING LOG 1800107 DADE CITY WATER TANK GPJ UES NEW.GDT 6/29/18



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BORING LOG

PROJECT NO.: 0830.1800107

APPENDIX:

PAGE: 1

PROJECT: Proposed Dade City Elevated Water Tank and Well Project
Skyline Drive
Dade City, FL

BORING DESIGNATION: **B-7**
SECTION:

TOWNSHIP:

SHEET: **1 of 1**
RANGE:

ENGINEER: Thomas J. Grimm

G.S. ELEVATION (ft):

DATE STARTED: 6/11/18

CLIENT: Infrastructure Solution Services

WATER TABLE (ft): >10.0

DATE FINISHED: 6/11/18

LOCATION: SEE BORING LOCATION PLAN

DATE OF READING: 6-11-2018

DRILLED BY: J.H

REMARKS:

EST. W.S.W.T. (ft):

TYPE OF SAMPLING: SPT

DEPTH (ft)	S A M P L E	N (bpf)	SPT-N vs DEPTH (bpf)	G W T	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		Kh (ft/day)	ORG (%)	DEPTH (ft)
									LL	PI			
0						Dark brown sand (SP)							0
						Brown sand (SP)							
5						Orange brown silty sand (SM)							5
		3											
		4											
		5				Orange brown sand with clay (SP-SC)							
10		5											10
						Orange brown silty sand (SM)							
15		6											15
20		10				Boring terminated at 20 ft.							20

NEW UES BORING LOG - 1800107 DADE CITY WATER TANK.GPJ UES NEW.GDT 6/29/18



SOIL CLASSIFICATION CHART

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE-GRAINED SOILS (major portions retained on No. 200 sieve): includes (1) clean gravel and sands and (2) silty or clayey gravels and sands. Condition is rated according to relative density as determined by laboratory tests or standard penetration resistance tests.

Descriptive Terms	Relative Density	SPT Blow Count
Very loose	0 to 15 %	< 4
Loose	15 to 35 %	4 to 10
Medium dense	35 to 65 %	10 to 30
Dense	65 to 85 %	30 to 50
Very dense	85 to 100 %	> 50

FINE-GRAINED SOILS (major portions passing on No. 200 sieve): includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings, SPT blow count, or unconfined compression tests.

Unconfined Compressive		
Descriptive Terms	Strength kPa	SPT Blow Count
Very soft	< 25	< 2
Soft	25 to 50	2 to 4
Medium stiff	50 to 100	4 to 8
Stiff	100 to 200	8 to 15
Very stiff	200 to 400	15 to 30
Hard	> 400	> 30

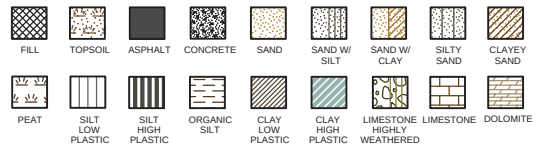
GENERAL NOTES

1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.

2. Surface elevations are based on topographic maps and estimated locations.

3. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were made. They are not guaranteed to be representative of subsurface conditions at other locations or times.

SOIL SYMBOLS



OTHER SYMBOLS

Measured Water Table Level Estimated Seasonal High Water Table

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria			Particle Size		
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 5 to 12 percent..... Borderline cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		mm < #200	#200 to #40 #40 to #10 #10 to #4	
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW				
			GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-line cases requiring use of dual symbols			
			GC	Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7				
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		mm < 0.074	0.074 to 0.42 0.42 to 2.00 2.00 to 4.76	
			SP	Poorly-graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW				
			SM	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are border-line cases requiring use of dual symbols			
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7		Material Silt or clay Sand Fine Medium Coarse		
	Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)					FOR CLARIFICATION OF FINE-GRAINED SOIL AND FINE-GRAINED FRACTION OF COARSE-GRAINED SOILS 	Particle Size			
Material							Sieve			
							mm	Gravel		
								Fine		
								Coarse		
								Cobble		
								Boulders		
Silt and Clays (Liquid limit less than 50)	Gravel									
	Fine									
	Coarse									
	Cobble									
	Boulders									

* When the percent passing a No. 200 sieve is between 5% and 12%, a dual symbol is used to denote the soil. For example; SP-SC, poorly-graded sand with clay content between 5% and 12%.

APPENDIX C

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 you GBC-Member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910

Telephone: 301/565-2733 Facsimile: 301/589-2017

e-mail: info@geoprofessional.org www.geoprofessional.org

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CONSTRAINTS AND RESTRICTIONS

WARRANTY

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until construction begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other explorations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of exploration. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.