INVITATION FOR BID
IFB #14-0667CD
SLUDGE HOLDING TANK IMPROVEMENTS AT THE SOUTHEAST WATER RECLAMATION FACILITY

Manatee County, a political subdivision of the State of Florida, (hereinafter "County") will receive sealed Bids from individuals, corporations, partnerships, and other legal entities organized under the laws of the State of Florida or authorized to conduct business in the State of Florida.

NON-MANDATORY INFORMATION CONFERENCE
In order to ensure that all prospective Bidders have sufficient information and understanding of County's needs, an Information Conference will be held at: **9:00 AM on February 25, 2014** at the **Southeast Water Reclamation Facility, 3331 Lena Road, Bradenton, FL 34202**. Attendance is not mandatory, but is highly encouraged.

DEADLINE FOR CLARIFICATION REQUESTS: **3:00 PM on March 7, 2014**
(Reference Bid Article A.05)

TIME AND DATE DUE: **3:00 PM on March 19, 2014**

FOR INFORMATION CONTACT:
Chris Daley-CPPB, Contract Specialist
(941) 749-3048, Fax (941) 749-3034
chris.daley@mymanatee.org
Manatee County Financial Management Department
Purchasing Division

AUTHORIZED FOR RELEASE:

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IFB #14-0667CD

SECTION A

INFORMATION TO BIDDERS

A.01 OPENING LOCATION

Sealed Bids will be **publicly opened** at the **Manatee County Purchasing Division, 1112 Manatee Avenue West, Suite 803, Bradenton, Florida 34205** in the presence of County officials at the time and date stated, or soon thereafter. All Bidders or their representatives are invited to be present.

Any Bids received after the stated time and date will not be considered. It shall be the sole responsibility of the Bidder to have their Bid delivered to the Manatee County Purchasing Division for receipt on or before the stated time and date. Bidder shall be solely and strictly responsible for its timely delivery to the Purchasing Division. Bids delayed by mail, courier, or Bids delayed for any other reason, shall not be considered, shall not be opened at the public opening, and arrangements shall be made for their return at the Bidder's request and expense.

A.02 SEALED & MARKED

Bids shall be submitted in **triplicate, one original (marked Original) and two (2) copies (marked Copy)** of your **signed Bid** shall be submitted in one **sealed** package, clearly marked on the outside **"Sealed Bid #14-0667CD- Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility"** along with your company name. For your convenience, a mailing label is provided with this Invitation for Bid package. Or, you may address the package as follows:

Address package to: Manatee County Purchasing Division
1112 Manatee Avenue West, Suite 803
Bradenton, Florida 34205
Sealed Bid # _____, Title _____

All blank spaces must be filled in as noted with amounts extended and totaled and no changes shall be made in the wording of the forms or in the items mentioned therein. In the event a change is made in your submittal, the Bidder shall write its initials by the change. Any Bid may be rejected which contains any omissions, alterations, irregularities of any kind, or which shall in any manner fail to conform to Bid requirements.

A Bid made by an individual, either in his/her own or proper person or under a trade or firm name, shall be executed under the individual's signature. If made by a partnership, the Bid shall be executed by two or more of the general partners. If made by a corporation, the Bid shall be executed by its President or other legally authorized corporate officer or agent.

A.03 SECURING OF DOCUMENTS

Invitation for Bids (IFB) and related documents are available on http://www.mymanatee.org/purchasing for download in a portable document format (.PDF) file by clicking on "Bids and Proposals" from the Purchasing Division's web page. You may view and print these files using Adobe Reader software. If necessary, you may download a free copy of Adobe Reader from the link provided on the "Bids and Proposals" page.

Additionally, Manatee County collaborates with the Manatee Chamber of Commerce by emailing solicitation opportunities to its members.

Manatee County may also use DemandStar to distribute Bids. On the DemandStar web site, http://www.DemandStar.com, click on the tab titled "My DemandStar" for more information regarding this service. Participation in the DemandStar system is not a requirement for doing business with Manatee County.

Complete copies of the IFB and all related documents are available for public inspection at the Manatee County Purchasing Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205, or by calling (941) 749-3014. Appointments are encouraged. Documents are available between the hours of 9:00 AM and 4:00 PM Monday through Friday, with the exception of holidays. A complete set of the IFB documents must be used in preparing Bids. County assumes no responsibility for errors and misinterpretations resulting from the use of incomplete sets of Bid Documents.

A.04 MODIFICATION OF IFB DOCUMENTS

If a Bidder wishes to recommend changes to the IFB documents, the Bidder shall furnish, in writing, data and information necessary to aid County in evaluating the request to modify the Specifications. County is not obligated to make any changes to the IFB documents. Unless an Addendum is issued, the IFB documents shall remain unaltered. **Bidders must fully comply with the IFB documents in their entirety.**

A.05 DEADLINE FOR CLARIFICATION REQUESTS

3:00 PM on March 7, 2014 shall be the deadline to submit all inquiries, suggestions, or requests concerning interpretation, clarification or additional information pertaining to this Invitation for Bid to the Manatee County Purchasing Division.

This deadline has been established to maintain fair treatment of all potential Bidders, while maintaining progression of the Project to promote economic stimulus.

A.06 CLARIFICATION & ADDENDA

Each Bidder shall examine all Invitation for Bid Documents and shall judge all matters relating to the adequacy and accuracy of such documents. Any inquiries, suggestions or requests concerning interpretation, clarification or additional information pertaining to this Invitation for Bid shall be made through the Manatee County Purchasing Division. County shall not be responsible for oral interpretations given by any County employee, representative, or others.

The issuance of a written Addendum is the only official method whereby interpretation, clarification or additional information can be given.

If any Addenda are issued to this Invitation for Bid, County will post the documents on the Purchasing Division's web page, which can be accessed at http://www.mymanatee.org/purchasing, and then by clicking on "Bids and Proposals". If the original solicitation was broadcast via DemandStar, the addenda will also be broadcast on the DemandStar distribution system to "Planholders" on this web service.

It shall be the **responsibility of each Bidder, prior to submitting their Bid**, to contact the Manatee County Purchasing Division (see contact information on the cover page) to **determine if any Addenda were issued** and to make such Addenda a part of their Bid.

A.07 LOBBYING

After the issuance of any Invitation for Bid prospective Bidders, or any agent, representative or person acting at the request of such Bidder shall not contact, communicate with or discuss any matter relating in any way to the Invitation for Bid with any officer, agent or employee of Manatee County other than the Purchasing Official or as directed in the Invitation for Bid, pursuant to the Manatee County Code. This prohibition includes the act of carbon copying officers, agents or employees of Manatee County on all correspondence, including email correspondence. This requirement begins with the issuance of an Invitation for Bid, and ends upon execution of Contract or when the invitation has been cancelled. Violators of this prohibition shall be subject to sanctions as provided in the Manatee County Code.

A.08 UNBALANCED BIDDING PROHIBITED

County recognizes that large and/or complex Projects will often result in a variety of methods, sources, and prices. However, where in the opinion of County such variation does not appear to be justified, given Bid requirements and industry and market conditions, the Bid will be presumed to be unbalanced. Examples of unbalanced Bids will include:

a. Bids showing omissions, alterations of form, additions not specified, or required conditional or unauthorized alternate Bids.

A.08 UNBALANCED BIDDING PROHIBITED (Continued)

b. Bids quoting prices that substantially deviate, either higher or lower, from those included in the Bids of competitive Bidders for the same line item unit costs.

c. Bids where the unit costs offered are in excess of or below reasonable cost analysis values.

In the event County determines that a Bid is presumed unbalanced, it will request the opportunity to, and reserves the right to, review all source quotes, Bids, price lists, letters of intent, etc., which the Bidder obtained and upon which the Bidder relied upon to develop its Bid. County reserves the right to reject as non-responsive any presumptive unbalanced Bids where the Bidder is unable to demonstrate the validity and/or necessity of the unbalanced unit costs.

A.09 FRONT END LOADING OF BID PRICING PROHIBITED

Prices offered for performance and/or acquisition activities to occur early in the Project schedule, such as mobilization; clearing and grubbing; or maintenance of traffic; that are substantially higher than pricing of competitive Bidders within the same portion of the Project schedule, will be presumed to be front end loaded. Front end loaded Bids could reasonably appear to be an attempt to obtain unjustified early payments creating a risk of insufficient incentive for the Bidder to complete the Work or otherwise creating an appearance of an undercapitalized Bidder.

In the event County determines that a Bid is presumed to be front end loaded, it will request the opportunity to, and reserves the right to, review all source quotes, bids, price lists, letters of intent, etc., which the Bidder obtained and upon which the Bidder relied upon to develop the pricing or acquisition timing for these Bid items. County reserves the right to reject as non-responsive any presumptive front end loaded Bids where the Bidder is unable to demonstrate the validity and/or necessity of the front end loaded costs.

A.10 WITHDRAWAL OF OFFERS

Bidders may withdraw offers as follows:

a. Mistakes discovered before the opening of a solicitation may be withdrawn by written notice from the Bidder submitting the Bid. This request must be received in the office designated for receipt of Bids in the solicitation document prior to the time set for delivery and opening of the Bids. A copy of the request shall be retained and the unopened Bid returned to that Bidder; or

b. After the responses to a solicitation are opened or a selection has been determined, but before a Contract is signed, a Bidder alleging a material mistake of fact may be permitted to withdraw their Bid if:

A.10 WITHDRAWAL OF OFFERS (Continued)

1. the mistake is clearly evident in the solicitation document; or

2. Bidder submits evidence which clearly and convincingly demonstrates that a mistake was made. Request to withdraw a Bid must be in writing and approved by the Purchasing Official.

A.11 IRREVOCABLE OFFER

Any Bid may be withdrawn up until the time and date set for opening of the Bid. Any Bid not so withdrawn shall, upon opening, constitute an irrevocable offer for a period of ninety (90) days to sell to Manatee County the goods or services set forth in the attached IFB until one or more of the Bids have been duly accepted by County.

A.12 BID EXPENSES

All expenses for making Bids to County are to be borne by the Bidder.

A.13 RESERVED RIGHTS

County reserves the right to accept or reject any and/or all Bids, to waive irregularities and technicalities, and to request resubmission. Also, County reserves the right to accept all or any part of the Bid and to increase or decrease quantities to meet additional or reduced requirements of County. Any sole response received by the first submission date may or may not be rejected by County depending on available competition and current needs of County. For all items combined, the Bid of the lowest, responsive, responsible Bidder will be accepted, unless all Bids are rejected.

The lowest, responsible Bidder shall mean that Bidder who makes the lowest Bid to sell goods and/or services of a quality which meets or exceeds the quality of goods and/or services set forth in the IFB documents or otherwise required by County, and who is fit and capable to perform the Bid as made.

To be responsive, a Bidder shall submit a Bid which conforms in all material respects to the requirements set forth in the Invitation for Bid.

To be a responsible Bidder, the Bidder shall have the capability in all respects to perform fully the Bid requirements, and the tenacity, perseverance, experience, integrity, reliability, capacity, facilities, equipment, and credit which will assure good faith performance.

Also, County reserves the right to make such investigation as it deems necessary to determine the ability of any Bidder to furnish the service requested. Information County deems necessary to make this determination shall be provided by the Bidder. Such information may include, but shall not be limited to current financial statements, verification of availability of equipment and personnel, and past performance records.

A.14 APPLICABLE LAWS

Bidder must be authorized to transact business in the State of Florida. All applicable laws and regulations of the State of Florida and ordinances and regulations of Manatee County will apply to any resulting Contract. Any involvement with the Manatee County Purchasing Division shall be in accordance with the Manatee County Purchasing Ordinance as amended.

A.15 COLLUSION

By submitting a Bid to this Invitation for Bid, the Bidder certifies that it has not divulged, discussed or compared its Bid with any other Bidder, and has not colluded with any other Bidder or parties to this Bid whatsoever. Also, Bidder certifies, and in the case of a joint Bid each party thereto certifies as to their own organization, that in connection with this Bid:

a. any prices and/or cost data submitted have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices and/or cost data, with any other Bidder or with any competitor;

b. any prices and/or cost data quoted for this Bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder, prior to the scheduled opening, directly or indirectly to any other Bidder or to any competitor;

c. no attempt has been made or will be made by the Bidder to induce any other person or firm to submit or not to submit a Bid for the purpose of restricting competition;

d. the only person or persons interested in this Bid, principal or principals is/are named therein and that no person other than therein mentioned has any interest in this Bid or in the resulting Contract to be entered into; and

e. no person or agency has been employed or retained to solicit or secure the resulting Contract upon an agreement or understanding or a commission, percentage, brokerage, or contingent fee except bona fide employees or established commercial agencies maintained by Bidder for purpose of doing business.

A.16 CODE OF ETHICS

With respect to this Bid, if any Bidder violates, directly or indirectly, the ethics provisions of the Manatee County Purchasing Ordinance and/or Florida criminal or civil laws related to public procurement, including but not limited to Florida Statutes, Chapter 112, Part III, Code of Ethics for Public Officers and Employees, such Bidder will be disqualified from eligibility to perform the Work described in this Invitation for Bid, and may also be disqualified from furnishing future goods or services to, and from submitting any future Bids to supply goods or services to, Manatee County.

A.16 CODE OF ETHICS (Continued)

By submitting a Bid, the Bidder represents to County that all statements made and materials submitted are truthful, with no relevant facts withheld. If a Bidder is determined to have been untruthful in their Bid or any related presentation, such Bidder will be disqualified from eligibility to perform the Work described in this Invitation for Bid, and may also be disqualified from furnishing future goods or services to, and from submitting any future Bids to supply goods or services to, Manatee County.

A.17 PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES

A person or affiliate who has been placed on the State's convicted vendor list following a conviction for a public entity crime, as that term is defined in Florida Statute § 287.133, may not submit a Bid to provide any goods or services to a public entity; may not submit a Bid with a public entity for the construction or repair of a public building or public work; may not submit Bids on leases of 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 Florida Statutes § 287.017 for CATEGORY TWO for a period of thirty-six (36) months following the date of being placed on the convicted list.

In addition, the Manatee County Code prohibits the Award of any resulting Contract to any person or entity who/which has, within the past five (5) years, been convicted of, or admitted to in court or sworn to under oath, a public entity crime or of any environmental law that, in the reasonable opinion of the Purchasing Official, establishes reasonable grounds to believe the person or business entity will not conduct business in a responsible matter.

To ensure compliance with the foregoing, the Code requires all persons or entities desiring to contract with County to execute and file with the Purchasing Official an affidavit, executed under the pain and penalties of perjury, confirming that person, entity and any person(s) affiliated with the entity, does not have such a record and is therefore eligible to seek and be awarded business with County. In the case of a business entity other than a partnership or a corporation, such affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, such affidavit shall be executed by the general partner(s). A Public Contracting and Environmental Crimes Certification form is included (reference Form B of this document) for this purpose.

A.18 BID FORMS

Bids must be submitted on attached provided forms, although additional pages may be attached. **Bidders must fully complete all pages of the Bid Forms. Bid Forms must be executed by an authorized signatory who has the legal authority to make the Bid and bind the company. Bidders must fully comply with all requirements of this IFB in its entirety.** Failure to comply shall result in default of the resulting Contract, whereupon, the defaulting Contractor shall be required to pay for any and all re-procurement costs, damages, and attorney fees as incurred by County.

A.19 LEGAL NAME

Bids shall clearly indicate the legal name, address and telephone number of the Bidder on the Bid Form. Bid Forms shall be signed above the typed or printed name and title of the signer. The signer must have the authority to bind the Bidder to the submitted Bid.

When Bidder is a partnership, the Bid Form shall be signed in the name of the firm and by all partners required under the terms of the partnership agreement. When a corporation is a Bidder, the authorized corporate officers shall sign.

Bidders who are corporations or limited partnerships shall provide a certified copy of their permit to transact business in the State of Florida, preferably along with the Bid Form, or within forty-eight (48) hours after request by County.

When submitting a Bid as a joint venture, it must have filed paper documents with the Division of Profession's Construction Industry Licensing Board prior to submitting a Bid.

A.20 DISCOUNTS

Any and all discounts must be incorporated in the prices contained in the Bid and not shown separately. The prices as shown on the Bid Form shall be the prices used in determining Award.

A.21 TAXES

Manatee County is exempt from Federal Excise and State Sales Taxes. (F.E.T. Cert. No. 59-78-0089K; Florida Sales Tax Exempt Cert. No. 85-8012622206C-6); therefore, the Bidder is prohibited from delineating a separate line item in his Bid for any sales or service taxes. Nothing herein shall affect the Bidder's normal tax liability.

A.22 DESCRIPTIVE INFORMATION

Unless otherwise specifically provided in the IFB documents, all equipment, materials and articles provided shall be new and of the most suitable grade for the purpose intended. Unless otherwise specifically provided in the IFB documents, reference to any equipment, material, article or patented process, by trade name, brand name, make or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition.

A.23 AMERICANS WITH DISABILITIES ACT

County does not discriminate upon the basis of any individual's disability status. This non-discrimination policy involves every aspect of County's functions including one's access to, participation, employment, or treatment in its programs or activities. Anyone requiring **reasonable accommodation** for an Information Conference or Bid Opening should contact the person named on the cover page of this Bid document at least twenty-four (24) hours in advance of either activity.

A.24 EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

In accordance with the provisions of Title VI of the Civil Rights Act of 1964 and Title 15, Part 8 of the Code of Federal Regulations, County hereby notifies all prospective Bidders that they will affirmatively ensure minority business enterprises will be afforded full opportunity to participate in response to this advertisement and will not be discriminated against on the grounds of race, color or national origin in consideration for Bid Award.

A.25 MBE/DBE

The State of Florida, Office of Supplier Diversity provides the certification process and the database for identifying certified MBE/DBE firms. This service may be directly accessed at: http://www.osd.dms.state.fl.us/iframe.htm

If you have any questions regarding this State service, please contact their office at (850) 487-0915.

A.26 MATHEMATICAL ERRORS

In the event of multiplication/extension error(s), the unit price shall prevail. In the event of addition error(s) the extension totals will prevail. All Bids shall be reviewed mathematically and corrected, if necessary, using these standards, prior to additional evaluation.

A.27 DISCLOSURE

Upon receipt, all inquiries and responses to inquiries related to this Invitation for Bid become “Public Records”, and shall be subject to public disclosure consistent with Florida Statues, Chapter 119.

Bids become subject to disclosure thirty (30) days after the opening or if a Notice of Intent to Award decision is made earlier than this time as provided by Florida Statutes § 119.071(1)(b). No announcement or review of the Bid shall be conducted at the public opening.

Based on the above, County will receive Bids at the time and date stated, and will make public at the opening the names of the business entities of all that submitted a Bid and any amount presented as a total offer without any verification of the mathematics or the completeness of the Bid.

A.27 DISCLOSURE (Continued)

If County rejects all Bids and concurrently notices its intent to reissue the solicitation, the rejected Bids are exempt from public disclosure until such time as County provides notice of an intended decision concerning the reissued solicitation or until County withdraws the reissued solicitation. A Bid is not exempt for longer than twelve (12) months after the initial notice rejecting all Bids.

Pursuant to Florida Statutes 119.0701, to the extent Successful Bidder is performing services on behalf of County, Successful Bidder must:

a. Keep and maintain public records that ordinarily and necessarily would be required by County in order to perform the service;

b. Provide the public with access to public records on the same terms and conditions that County would provide and at a cost that does not exceed the cost provided in Florida Statutes, Chapter 119, or as otherwise provided by 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, and;

d. Meet all requirements for retaining public records and transfer, at no cost, to County all public records in possession of Successful Bidder upon termination of the awarded Contract and/or PO and destroy any duplicate public records that are exempt or confidential from public records disclosure requirements. All records stored electronically must be provided to County in a format that is compatible with County's information technology systems.

A.28 LOCAL PREFERENCE

a. Local business is defined as a business legally authorized to engage in the sale of the goods and/or services to be procured, and which certifies within its Bid that for at least six (6) months prior to the announcement of the solicitation of Bids it has maintained a physical place of business in Manatee, Desoto, Hardee, Hillsborough, Pinellas or Sarasota County with at least one full-time employee at that location.

b. Local preference shall not apply to the following categories of Contracts:

    1. Purchases or Contracts which are funded, in whole or in part, by a governmental or other funding entity, where the terms and conditions of receipt of the funds prohibit the preference;

A.28 LOCAL PREFERENCE (Continued)

2. Any Bid announcement which specifically provides that the general local preference policies set forth in this section are suspended due to the unique nature of the goods or services sought, the existence of an emergency as found by either the County Commission or County Administrator, or where such suspension is, in the opinion of the County Attorney, required by law.

c. To qualify for local preference under this section, **a local business must certify to County** by completing an "**Affidavit as to Local Business Form"**, which is available for download at www.mymanatee.org/vendor. Click on "Affidavit for Local Business" to access and print the form. Complete, notarize, and mail the notarized original to the following address: Manatee County Purchasing Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205.

It is the responsibility of the Bidder to ensure accuracy of the Affidavit as to Local Business and notify County of any changes affecting same. Bidder attests that it:

1. Has not within the five (5) years prior to the Bid announcement admitted guilt or been found guilty by any court or state or federal regulatory enforcement agency of violation of any criminal law, or a law or administrative regulation regarding fraud;

2. Is not currently subject to an unresolved citation or notice of violation of any Manatee County Code provision, except citations or notices which are the subject of a current legal appeal, as of the date of the Bid announcement;

3. Is not delinquent in the payment of any fines, liens, assessments, fees or taxes to any governmental unit or taxing authority within Manatee County, except any such sums which are the subject of a current legal appeal.

A.29 VENDOR REGISTRATION

All vendors are encouraged to register with Manatee County using the on-line "Vendor Registration" web page on www.mymanatee.org/purchasing.

Your cooperation in registering your business with Manatee County will enhance our opportunities to identify sources for goods and services, plus identify local businesses. This information is used for soliciting quotations up to $250,000.00 and for competitive solicitations of larger purchases.

You will note that Manatee County collaborates with the Manatee Chamber of Commerce (www.manateechamber.com) by emailing solicitation opportunities to its members.

Our staff can assist you with your registration as needed. Our office hours are 8:00 A.M. to 5:00 P.M., Monday through Friday on regular business days. Please call (941) 749-3014 if you wish to have a Purchasing staff member assist you.

A.29 VENDOR REGISTRATION (Continued)

Quick steps to registration: **www.mymanatee.org/purchasing**

A link to Vendor Registration is listed on the Purchasing Division's web page under "Register as a Vendor".

Click on "Vendor Registration Form" for on-line input.

Thank you for reviewing this information and considering registering your business with Manatee County. Registration is not mandatory; however, by taking the time to register, you are helping County to provide timely notifications of Quotation, Bid and Proposal opportunities to your business.

A.30 ePAYABLES

Manatee County and Clerk of the Circuit Court have partnered to offer the ePayables program, which allows payments to be made to vendors via credit cards. The Clerk will issue a unique credit card number to each vendor; the card has a zero balance until payments have been authorized.

After goods are delivered or services rendered, vendors submit invoices to the remit to address on the purchase order according to the current process. When payments are authorized, an email notification is sent to the vendor. The email notification includes the invoice number(s), invoice date(s), and amount of payment. Once the vendor receives the email, the credit card has been authorized to be charged for the amount listed in the email. When the vendor charges the full amount authorized in the email, the card will return to a zero balance until the next payment is authorized.

There is no cost for vendors to participate in this program; however, there may be a charge by the company that processes your credit card transactions.

If you are interested in participating in this program, please complete Form D, ePayables Application and return the completed form via email to Ms. Lori Bryan, Supervisor at lori.bryan@manateeclerk.com.

NOTE: ANY OR ALL STATEMENTS CONTAINED IN THE FOLLOWING SECTIONS: MIMIMUM QUALIFICATIONS & BASIS OF AWARD, GENERAL TERMS AND CONDITIONS, OR SPECIFICATIONS, WHICH VARY FROM THE INFORMATION TO BIDDERS, SHALL HAVE PRECEDENCE.

END OF SECTION A

SECTION B
BID SUMMARY

B.01 THE WORK

The Work included in this Bid consists of furnishing all labor, materials, and equipment necessary to provide the improvements to the sludge holding tanks at the Manatee County Southeast Water Reclamation Facility located at 3331 Lena Road in Bradenton, Florida as required by the technical specifications and drawings included with this Invitation for Bids.

The sludge holding tank improvements consists of the following:

- installation of a gravity belt thickener and discharge pump, complete with associated yard piping, electrical, instrumentation, and controls;
- installation of a sludge transfer pump, complete with associated yard piping, electrical, instrumentation, and controls;
- installation of a dual polymer feed system, complete with associated yard piping, electrical, instrumentation, and controls;
- construction of an open sided structure over the gravity belt thickener; including foundation, electrical and grounding;
- draining, removing, and disposal of the grit material in two sludge holding tanks; removal and replacement of the diffusers inside two (2) sludge holding tanks and any additional requirements covered in these contract documents.

The Successful Bidder shall furnish all Shop Drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all Work required by these Specifications.

The successful Bidder shall perform the Work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by County.

The Successful Bidder shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the Work, whether specifically indicated in the Bid Documents or not.

B.02 EXAMINATION OF BID DOCUMENTS AND SITE(S)

It is the responsibility of each Bidder before submitting a Bid, to (a) examine the Bid Documents thoroughly; (b) visit the site(s) to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the Work; (c) consider federal, state, and local codes, laws, and regulations that may affect costs, progress, performance, or furnishing of the Work; (d) study and carefully correlate Bidder's observations with the Bid Documents; and (e) notify County of all conflicts, errors, or discrepancies in the Bid Documents.

Each Bidder may, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies, and obtain any additional information and data which pertain to the physical conditions at or contiguous to the site(s) or otherwise which may affect cost, progress, performance or furnishing of the Work and which Bidder

deems necessary to determine his Bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the Bid Documents. County will provide each Bidder access to the site(s) to conduct such explorations and tests.

Bidder shall fill all holes, clean up and restore the site(s) to its former condition upon completion of such explorations. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and other lands designated for use by Contractor in performing the Work are identified in the Bid Documents.

All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by County unless otherwise provided in the Bid Documents.

Inspection of the site(s) is **a requirement** to be considered for Award of this Bid. Prior to submitting a Bid, each Bidder shall examine the site(s) and all conditions thereon fully familiarizing themselves with the full scope of the Project. Failure to become familiar with site conditions will in no way relieve the Successful Bidder from the necessity of furnishing any materials or performing any Work that is required to complete the Project in accordance with the plans and Specifications. Bidder shall acknowledge inspection of the Project site(s) on his/her signed, submitted Bid Form.

The informational conference will be held on site with construction site inspection immdetiately following. After the date of the informational conference has passed, any potential Bidder wishing to conduct a site visit shall contact Anthony Benitez at 941-708-7450 ext 7333 for coordination of the site visit.

END OF SECTION B

SECTION C

BASIS OF AWARD & MINIMUM QUALIFICATIONS

C.01 BASIS OF AWARD

Award shall be to the lowest, responsive, responsible Bidder meeting Specifications and having the lowest total offer for **Bid "A"**, or the lowest total offer for **Bid "B"**, for the requirements listed on the Bid Form for the Work as set forth in this Invitation for Bid. Bid prices shall include costs for furnishing all labor, equipment and/or materials for the completion of the Work in accordance with and in the manner set forth and described in the Bid Documents to County's satisfaction within the prescribed time.

Two schedules for completion of Work shall be considered. Each Bid for completion by the specified stated time shall be offered as a separate "total offer". County has the sole authority to select the Bid based on the completion time which is in the best interest of County. Only one Award shall be made.

NOTE: Inspection of the site is a pre-requisite to be considered for Award of this Bid.

In evaluating Bids, County shall consider the qualifications of the Bidders; and if required, may also consider the qualifications of the Subcontractors, Suppliers, and other persons and organizations proposed. County may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work.

Whenever two or more Bids are equal with respect to price, the Bid received from a local business shall be given preference in Award. Whenever two or more Bids which are equal with respect to price are received, and neither of these Bids are from a local business, the Award shall be determined by a chance drawing, coin toss, or similar tie-breaking method conducted by the Purchasing Division and open to the public.

C.02 MINIMUM QUALIFICATIONS OF BIDDERS

No person who is not certified or registered as a General Contractor pursuant to Florida Statutes, Chapter 489 on the day the Bid is submitted, and who has continuously held that certification or registration for a period of at least three (3) consecutive years immediately prior to the day the Bid is submitted, may be qualified to bid on this Project. In the event that a Bidder is a business organization, including a partnership, corporation, business trust or other legal entity as set forth in Florida Statutes § 489.119(2), then the Bidder shall only be qualified to bid on this Project if: 1) the Bidder (the business organization) is on the day the Bid is submitted, and for at least three (3) consecutive years immediately prior to the day the Bid is submitted has been, in continuous existence, properly licensed and registered as required by Florida law; and 2) the Bidder, on the day the Bid is submitted, has a certified or registered Qualifying Agent, as required by Florida Statutes § 489.119, and that Qualifying Agent has been the same Qualifying Agent of the Bidder for a period of at least three (3) consecutive years immediately prior to the day the Bid is submitted.

END OF SECTION C

SECTION D

GENERAL TERMS & CONDITIONS

D.01 CONTRACT FORMS

The Contract resulting from the acceptance of a Bid shall be in the form of the Contract stated in this Bid (reference Section F of this document).

A written notice confirming Award or recommendation thereof will be forwarded to the Successful Bidder accompanied by the required number of unsigned counterparts of the Contract. Within ten (10) days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Contract with any other required documents to County. (Note: Contract must be approved in accordance with Chapter 2-26 of the Manatee County Code, and the Administrative Standards and Procedures Manual approved by the County Administrator).

D.02 ASSIGNMENT OF CONTRACT

Contractor shall not assign, transfer, convey, sublet or otherwise dispose of the resulting Contract or of his right, title, or interest therein, or his power to execute such Contract, or to assign any monies due or to become due there under to any other person, firm or corporation unless first obtaining the written consent of County. The giving of such consent to a particular Subcontractor assignment shall not dispense with the necessity of such consent to any further or other assignment.

D.03 COMPLETION OF WORK

The Work will be completed and ready for final inspection within the specified calendar days from the date the Contract Time commences to run. Two Bids shall be considered, **Bid "A"** based on **300 calendar days** and **Bid "B"** based on **365 calendar days**. County has the sole authority to select the Bid based on the completion time which is in the best interest of County. **Only one Award shall be made**.

D.04 LIQUIDATED DAMAGES

If the Contractor refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as will hinder its completion within the time specified, County may seek damages. The actual damages for delay will be impossible to determine and in lieu thereof, the Contractor shall pay to County the sum of **$1532** as fixed, agreed, and liquidated damages for each calendar day of the delay until the Work is finally accepted by County and the Contractor and his Surety shall be liable for the amount thereof.

D.05 PAYMENT

Contractor may apply for partial payment on monthly estimates, based on the amount of the Work done or completed in compliance with the provisions of the resulting Contract. Contractor shall submit an application, on a standard pay application form provided or approved by County, of an approximate estimate of the proportionate value of the Work done, items and locations of the Work performed up to and including the last day of the period then ending.

D.05 PAYMENT (Continued)

County will then review said estimate and make any necessary revisions so that the estimate can receive approval for payment. If the Contractor and County do not agree on the approximate estimate of the proportionate value of the Work done for any pay period, the determination of County will be binding. The amount of said estimate after deducting any required Retainage and all previous payments shall be due and payable to the Contractor, twenty (20) business days if County is its own Engineer of Record (EOR) or twenty-five (25) business days if outside agent approval is required after the pay estimate has been approved by the agent for County.

In accordance with the Prompt Payment Act, Florida Statutes § 218.735(7), a Punch List shall be formulated.

Time allowed for development of Punch List:

a. Awarded Contracts with an estimated cost of less than $10 million will be within thirty (30) calendar days after reaching Substantial Completion.

b. Awarded Contracts with a cost of $10 million dollars or more will be within thirty (30) calendar days OR if extended by Contract, up to sixty (60) calendar days after reaching Substantial Completion.

The Final Completion date of the resulting Contract must be at least thirty (30) days after delivery of the list of items. If the list is not provided to the awarded Contractor by the agreed upon date, the Contract completion time must be extended by the number of days County exceeds the delivery date.

It is the Contractor's responsibility for the care of the materials. Any damage to or loss of said materials is the full responsibility of the Contractor. Any periodical pay estimate signed by the Contractor shall be final as to the Contractor for any or all Work covered by the periodical pay estimate.

Any requests for payment of materials stored on site must be accompanied with a paid receipt. The Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to County at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter referred to as "Liens").

The Contractor agrees to furnish an affidavit stating that all laborers, material men, and Subcontractors have been paid on the Project for Work covered by the Application for Payment and that a partial or complete release of lien, as may be necessary, be properly executed by the material men, laborers, Subcontractors on the Project for Work covered by the Application for Payment, sufficient to secure County from any claim whatsoever arising out of the aforesaid Work. When the Contractor has completed the Work in compliance with the terms of the Contract Documents, he shall notify County in writing that the Project is ready for final inspection.

D.05 PAYMENT (Continued)

County will then advise the Contractor as to the arrangements for final inspection and what Work, if any, is required to prepare the Project or a portion thereof for final inspection. When County determines the Project or portion thereof is ready for final inspection, County shall perform same. Upon completion of final inspection, County will notify Contractor of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies. When all such errors have been corrected, a final re-inspection will be made.

The process will be repeated until, in the opinion of County, the Project has been completed in compliance with the terms of the Contract Documents.

When final acceptance has been made by County, County will make final payment of the resulting Contract amount, plus all approved additions, less approved deductions and previous payments made. The resulting Contract will be considered complete when all Work has been finished, the final inspection made, approved as-builts received, and the Project finally accepted in writing by County. The Contractor's responsibility shall then terminate except as otherwise stated.

D.06 CONTRACT CONTINGENCY WORK

This Bid item entails a monetary allowance which is used at County's discretion to handle unexpected conditions as required to satisfactorily complete the Project in accordance with the plans and Specifications. A Field Directive must be issued by an authorized County Representative to authorize use of Contract Contingency funds.

The percentage for Contract Contingency is listed on the Bid Form. Vendor shall enter the amount for Contract Contingency based on the percentage of their Total Base Bid. The total Contract Award will include the Contract Contingency funds.

Appropriate uses of Contract Contingency funds include increases to existing Bid item quantities that do not change the initial Scope of Work, which may be directed by staff; modification items not originally bid which were unforeseen yet necessary during the construction to provide a safe, complete Project and that do not change the initial Scope of Work; and unanticipated conflicts and/or design changes required during construction which are necessary to provide a safe, complete Project and that do not change the initial Scope of Work.

Inappropriate uses of Contract Contingency funds include anything that changes the initial Scope of Work, including the Contract Price and Contract Time, and adding Bid items not previously contemplated that change the initial Scope of Work.

D.07 RETAINAGE

A Retainage of 10% of the total Work in place shall be withheld until 50% complete. After 50% completion, the Retainage shall be reduced to 5% of the total Work in place until Final Completion and acceptance of the Work by County. Upon final acceptance, the remaining Retainage shall be included in the final payment.

D.08 PROGRESS REQUIREMENTS

All Work done under the resulting Contract shall be done with a minimum of inconvenience to the private property owners in the area. The Contractor shall coordinate his Work with private property owners such that existing utility services are maintained and they have access to their property at all times.

D.09 WARRANTY AND GUARANTEE PROVISIONS

All Work, materials, and equipment furnished as defined herein shall be guaranteed and warranted by the Contractor for a minimum period of three (3) years, unless otherwise specified, from final acceptance by County to be free from defects due either to faulty materials or equipment or faulty workmanship.

All materials, equipment, and workmanship furnished and installed by the Contractor is warranted and guaranteed by the Contractor to meet the required standards and to accomplish the purposes and functions of the Project as defined, detailed, and specified herein.

County shall, following discovery thereof, promptly give written notice to the Contractor of faulty materials, equipment, or workmanship within the period of the guarantee and the Contractor shall promptly replace any part of the faulty equipment, material, or workmanship at his own cost. These warranty and guarantee provisions create no limitations on County as to any claims or actions for breach of guaranty or breach of warranty that County might have against parties other than the Contractor, and do not constitute exclusive remedies of County against the Contractor.

D.10 MATERIALS AND WORKMANSHIP

All materials and apparatus required for this Work, except as specified otherwise, shall be new, of first class quality, and shall be furnished, delivered, connected and finished in every detail. Construction shall be prescribed by good industry practice and in accordance with manufacturer's recommendations for the type being installed.

Use skilled workman trained and experienced in the necessary trades and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this section.

D.11 PROJECT CLOSE-OUT

Clean construction site and remove any and all excess materials. Correct any damages to property that may have occurred as a result of installation and/or delivery. Repair and patch all surfaces cut for installation. The Contractor shall remedy any deficiencies promptly should County determine any Work is incomplete or defective.

D.11 PROJECT CLOSE-OUT (Continued)

When County determines the Work is acceptable in accordance with this Invitation for Bid, the Contractor shall provide the close out submittals, including but not necessarily limited to the following:

1 set	Certificate of Warranties	
1 set	Manufacturer's Product Literature	(when applicable)
1 set	Project Record Drawings	
1 set	Subcontractor Information	(when applicable)

D.12 ROYALTIES AND PATENTS

The Contractor shall pay all royalties and license fees for equipment or processes in conjunction with the equipment and/or services being furnished. Contractor shall defend all suits or claims for infringement of any patent, trademark or copyright, and shall save County harmless from loss on account thereof, including costs and attorney's fees.

D.13 AUTHORIZED PRODUCT REPRESENTATION

The Bidder, by virtue of submitting the name and Specifications of a manufacturer's product, will be required to furnish the named manufacturer's product. Failure to perform accordingly may, in County's sole discretion, be deemed a Material Breach of the resulting Contract, and shall constitute grounds for County's immediate termination of the resulting Contract.

D.14 REGULATIONS

It shall be the responsibility of the Contractor to assure compliance with any OSHA, EPA and/or other federal or State of Florida rules, regulations or other requirements, as each may apply.

D.15 CANCELLATION

Any failure of the Contractor to furnish or perform the Work (including, but not limited to, commencement of the Work, failure to supply sufficient skilled workers or suitable materials or equipment) in accordance with the resulting Contract, County may order the stop of the Work, or any portion thereof, until the cause for such order has been eliminated. If the Contractor persistently fails to perform the Work in accordance with the resulting Contract, County reserves the right to terminate the resulting Contract and select the next qualified Bidder or re-advertise this procurement in part or in whole. County reserves the right to cancel all or any undelivered or unexecuted portion of the resulting Contract with or without cause.

D.16 INDEMNIFICATION

The Contractor covenants and agrees to indemnify and save harmless County, its agents and employees, from and against all claims, suits, actions, damages, causes of action, or judgments arising out of the terms of the resulting Contract for any personal injury, loss of life, or damage to the property sustained as a result of the performance or non-performance of services or delivery of goods; from and against any orders, judgments, or decrees, which may be entered against County, its agents or employees; and from and against all costs, attorney's fees, expenses and other liabilities incurred in the defense of any such claim, suit or action, and the investigation thereof. Nothing in the resulting Award, Contract or Purchase Order shall be deemed to affect the rights, privileges and immunities of County as set forth in Florida Statutes § 768.28.

D.17 SUBCONTRACTORS, SUPPLIERS AND OTHERS

The identity of Subcontractors, Suppliers, and other persons and organizations (including those who are to furnish the principal items of material and equipment) may be requested by County for each Bid item from any of the Bidders; and the Bidder shall respond within five (5) days after the date of such request. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, persons or organization if requested by County. If County, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, County may, before the Notice of Intent to Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in Contract Price or Contract Time.

If apparent Successful Bidder declines to make any such substitution, County may Award the resulting Contract to the next lowest qualified Bidder that proposes to use acceptable Subcontractors, Suppliers, and other persons who County does not make written objection to. Contractor shall not be required to employ any Subcontractor, Supplier, other person or organization who Contractor has reasonable objection to.

Subcontractors shall be bound by the terms and conditions of the resulting Contract insofar as it applies to their work, but this shall not relieve the prime Contractor from the full responsibility to County for the proper completion of all Work to be executed under the resulting Contract.

The employment of unauthorized aliens by any Contractor is considered a violation of Section 274 (e) of the Immigration and Employment Act. If the Contractor knowingly employs unauthorized aliens, such violation shall be cause for unilateral cancellation of the resulting Contract.

A complete list of all Subcontractors proposed for any portion of the Work may be requested of any Bidder deemed necessary by County. Subcontracts shall be awarded only to those Subcontractors considered satisfactory by County.

D.18 MANUALS, SCHEMATICS, HANDBOOKS (IF APPLICABLE)

All manuals, schematics and handbooks shall be provided which are applicable to the equipment delivered. An operators manual, parts manual and technician manual must also be provided. Parts lists (manuals) must include OEM part numbers for items not manufactured by the Contractor. Contractor shall furnish two (2) copies of each.

D.19 INSURANCE

The Contractor will not commence Work under the resulting Contract until all insurance under this section and such insurance coverage as might be required by County has been obtained. The Contractor shall obtain, and submit to the Purchasing Division within ten (10) calendar days from the date of Notice of Intent to Award, at his expense, the following minimum amounts of insurance (inclusive of any amounts provided by an umbrella or excess policy):

a. Workers' Compensation/Employers' Liability

Part One - There shall be no maximum limit (other than as limited by the applicable statute) for liability imposed by Florida Workers' Compensation Act or any other coverage required by the resulting Contract Documents which are customarily insured under Part One of the standard Workers' Compensation Policy.

Part Two - The minimum amount of coverage required by the resulting Contract Documents which are customarily insured under Part Two of the standard Workers' Compensation Policy shall be:

(Each Accident)	$100,000
(Disease-Policy Limit)	$500,000
(Disease-Each Employee)	$100,000

b. Commercial General Liability

The limits are to be applicable only to Work performed under the resulting Contract and shall be those that would be provided with the attachment of the Amendment of Limits of Insurance (Designated Project or Premises) endorsement (ISO Form CG 25 03) a Commercial General Liability Policy with the following minimum limits.

General Aggregate:	
Products/Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Each Occurrence	$1,000,000
Fire Damage (Any One Fire)	$Nil
Medical Expense (Any One Person)	$Nil

ADDITIONAL INSURED: Manatee County, a political subdivision of the State of Florida, shall be specifically named as additional insured on the Commercial General Liability Policy.

D.19 INSURANCE (Continued)

c. Business Auto Policy

Each Occurrence Bodily Injury and Property Damage Liability Combined	$300,000
Annual Aggregate (if applicable)	$1,000,000

ADDITIONAL INSURED: Manatee County, a political subdivision of the State of Florida, shall be specifically named as additional insured on the Business Auto Policy.

d. Property Insurance

If the resulting Contract includes construction of or additions to above ground buildings or structures, Contractor shall provide "**Builder's Risk**" insurance with the minimum amount of insurance to be 100% of the value of such addition(s), building(s), or structure(s).

e. Installation Floater

If the resulting Contract does not include construction of or additions to above ground building or structures, **but does involve** the installation of machinery or equipment, Contractor shall provide an "**Installation Floater**" with the minimum amount of insurance to be 100% of the value of such addition(s), building(s), or structure(s).

f. Certificates of Insurance and Copies of Policies

Certificates of Insurance in triplicate evidencing the insurance coverage specified herein shall be filed with the Purchasing Official before operations are begun. The required certificates of insurance shall name the types of policy, policy number, date of expiration, amount of coverage, companies affording coverage, and also shall refer specifically to the Bid number and title of the Project. All insurance policies required herein shall be issued by companies that are authorized to do business under the laws of the State of Florida and hold an A.M. Best rating of A- or better. Insurance, as specified herein, shall remain in force and effect for the duration of the Project including any warranty periods.

g. Complete Policies: The entire and complete insurance policies required herein shall be provided to County on request.

Nothing herein shall in any manner create any liability of County in connection with any claim against the Contractor for labor, services, or materials, or of Subcontractors; and nothing herein shall limit the liability of the Contractor or Contractor's Sureties to County or to any Workers, Suppliers, material men or employees in relation to the resulting Contract.

D.19 INSURANCE (Continued)

h. By way of its submission of a Bid hereto, Bidder:

1. Represents that Bidder maintains, and will maintain during the term of any Contract arising from this solicitation, insurance coverage from responsible companies duly authorized to do business in the State of Florida and deemed acceptable to County, as set forth in this solicitation; and

2. Agrees that, insurance should not be cancelled without thirty (30) days notice to County and must be endorsed to provide same. Failure of Bidder to obtain and maintain proper amounts of insurance at all times as called for herein shall constitute a Material Breach of the resulting Contract, which may result in immediate termination.

i. Certification Requirements – In order for the certificate of insurance to be accepted it **must** comply with the following:

1. The certificate holder shall be:
Manatee County Board of Commissioners,
A political subdivision of the State of Florida
P.O. Box 1000
Bradenton, FL 34206-1000
IFB# 14-0667CD, Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility

2. Certificate shall be mailed to:
Manatee County Purchasing Division
1112 Manatee Avenue West, Suite 803
Bradenton, FL 34205
Attn: Chris Daley, CPPB, Contract Specialist

D.20 BID BOND/CERTIFIED CHECK

By submitting a Bid to this Invitation for Bid, the Bidder agrees should the Bidder's Bid be accepted, **to execute the form of Contract and present the same to Manatee County for approval within ten (10) calendar days after Notice of Intent to Award**. The Bidder further agrees that failure to execute and deliver said form of Contract **within ten (10) calendar days** will result in damages to Manatee County and as guarantee of payment of same a Bid Bond/certified check shall be enclosed within the submitted sealed Bid in the amount of five (5%) percent of the total amount of the Bid. The Bidder further agrees that in case the Bidder fails to enter into a Contract, as prescribed by Manatee County, the Bid Bond/certified check accompanying the Bid shall be forfeited to Manatee County as agreed liquidated damages. If County enters into a Contract with a Bidder, or if County rejects any and/or all Bids, accompanying bond will be promptly returned.

D.21 PERFORMANCE AND PAYMENT BONDS

The Successful Bidder shall furnish Surety bonds using the Public Construction Bond form prescribed in Florida Statutes § 255.05, which is provided herein, as security for faithful performance of the Contract awarded as a result of this Bid and for the payment of all persons performing labor and/or furnishing material in connection therewith. Failure to provide the required bonds on the prescribed form may result in Successful Bidder being deemed nonresponsive. Bonds must be in the form prescribed in Florida Statutes § 255.05, and must not contain notice, demand or other terms and conditions, including informal pre-claim meetings, not provided for in Florida Statutes § 255.05.

Surety of such bonds shall be in an amount equal to 100% of the Contract Award issued by a duly authorized and nationally recognized Surety company, authorized to do business in the State of Florida, satisfactory to this County. Surety shall be rated as "A-" or better as to general policy holders rating and Class V or higher rating as to financial size category and the amount required shall not exceed 5% of the reported policy holders' surplus, all as reported in the most current Best Key Rating Guide, published by A.M. Best Company, Inc. of 75 Fulton Street, New York, New York, 10038. The attorney-in-fact who signs the bonds must file with the bonds, a certificate and effective dated copy of power-of-attorney. Performance and Payment Bonds shall be issued to Manatee County, a political subdivision of the State of Florida, within ten (10) calendar days after Notice of Intent to Award.

In addition, pursuant to Florida Statutes § 255.05(1)(b), prior to commencing Work, the Contractor shall be responsible and bear all costs associated to record the Performance and Payment Bond with the Manatee County Clerk of the Circuit Court. A certified copy of said recording shall be furnished to the Purchasing Division upon filing. Pursuant to Florida Statutes § 255.05(1)(b), County will make no payment to the Contractor until the Contractor has complied with this paragraph.

Furnishing Performance and Payment Bonds shall be requisite to execution of a Contract with County. Said Performance and Payment Bonds will remain in force for the duration of the Contract with the premiums paid by the Contractor. Failure of the Successful Bidder to execute such Contract and to supply the required bonds shall be just cause for cancellation of the Award. County may then contract with another acceptable Bidder or re-advertise this Invitation for Bid. If another Bidder is accepted, and notice given within ninety (90) days after the opening of the Bids, this acceptance shall bind the Bidder as though they were originally the Successful Bidder.

Failure of County at any time to require performance by the Contractor of any provisions set out in the resulting Contract will in no way affect the right of County, thereafter, to enforce those provisions.

When activity occurs within the resulting Contract that increases the amount of the Contract by either an approved Administrative Contract Adjustment (ACA) or an approved Change Order, a recorded Bond Rider shall be provided before the additional Work can proceed. All premiums shall be paid by the Contractor.

D.22 NO DAMAGES FOR DELAY

No claim for damages or any claim other than for an extension of time shall be made or asserted against County by reason of any delays. The Contractor shall not be entitled to an increase in the total Contract Price or payment or compensation of any kind from County or direct, indirect, consequential impact or other costs, expenses for damages, including but not limited to costs of acceleration or inefficiency arising because of delay, disruption, interference or hindrance from any cause whatsoever; provided, however, that this provision shall not preclude recovery or damages by the Contractor for hindrance or delays due solely to fraud, bad faith, or active interference on part of County or its agents. Otherwise, the Contractor shall only be entitled to extensions of the Contract Time as the sole and exclusive remedy for such resulting delay, in accordance with and to the extent specifically provided above.

D.23 NO INTEREST

Any monies not paid by County when claimed to be due to the Contractor under this Contract shall not be subject to interest including prejudgment interest. Any monies not paid by County when claimed to be due to the Contractor for damages awarded in the case of construction delays shall not be subject to prejudgment interest.

D.24 CONSTRUCTION OF CONTRACT

The resulting Contract and the rights and responsibilities hereunder shall not be construed more strongly against either party, regardless of the extent to which such party may have participated in the preparation hereof.

D.25 BE GREEN

All Contractors are encouraged to use as many **environmentally preferable** "green" products, materials, supplies, etc. as possible in order to promote a safe and healthy environment. **Environmentally preferable are products or services that have a reduced adverse effect on the environment**. Provide detail of your organization's initiative and its ability to meet the goal of environmental sustainability.

END OF SECTION D

SECTION E

GENERAL CONDITIONS

ARTICLE 1. DEFINITIONS

Whenever used in the Contract Documents, the following terms have the meaning indicated which are applicable to both the singular and plural thereof:

Addendum - Written or graphic instruments issued prior to the opening of Bids which clarify or change the Bid Documents.

Administrative Contract Adjustment (ACA) – A minor change to a Contract, which is less than 10% of the Contract Price or less than 20% of the Contract Time, and does not require Board approval. (Reference Resolution R-07-189)

Application for Payment - The form accepted by the Project Representative which is to be used by Contractor in requesting progress or final payments and which is to include such supporting documentation as is required by the Contract Documents.

Award - Acceptance of the Bid from the person, firm, or corporation which in the County's sole and absolute judgment will under all circumstances best serve the public interest. Award shall be made in accordance with Chapter 2-26 of the Manatee County Code.

Bid - The Offer of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

Bid Bond – An insurance agreement, accompanied by a monetary commitment, by which a third party (the Surety) accepts liability and guarantees that the Bidder will not withdraw the Bid.

Bidder - One who submits a Bid directly to the County, as distinct from a Sub-bidder, who submits a Bid to a Bidder.

Bid Documents - Consists of the Invitation for Bid, which includes but is not limited to the Bid Form, drawings, technical Specifications, terms and conditions, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids); and becomes a part of the resulting Contract.

Bid Summary – Specifications or scope of Work that specifically describes the Work to be done for this Project.

Bond Rider – A Bond Rider increases the Performance Bond coverage to ensure responsibility of the Contractor in executing the Work for the County in consideration of the increased value resulting from an approved change in the Contract amount.

Change Order - A document recommended by the Project Representative which is signed by Contractor and County and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Contract.

Compensable Delay - Any delay beyond the control and without the fault or negligence of the Contractor resulting from County-caused changes in the Work, differing site conditions, suspensions of the Work, or termination for convenience by County.

Contract - The written Contract between County and Contractor covering the Work to be performed; other Contract Documents are attached to the Contract and made a part thereof as provided therein.

Contract Contingency - A monetary allowance used at the County's discretion, which is part of the total sum of the Contract that allows for minor changes in the Contract that do not change the initial Scope of Work, including Contract Price and Contract Time.

Contract Documents - The Contract, Invitation for Bid in its entirety, Public Construction Bond Form and Insurance Certificate(s), Drawings/Plans, Addenda (which pertain to the Bid Documents), Contractor's Bid Form (including documentation accompanying the Bid and any post-Bid documentation submitted prior to the Notice of Award), and Reports, together with all written Change Orders and other documents amending, modifying or supplementing the Contract Documents issued on or after the Effective Date of the Contract.

Contract Price - The monies payable by County to Contractor under the Contract Documents as stated in the Contract.

Contract Time - The number of days or the date stated in the Notice to Proceed for the completion of the Work.

Contractor - The person, firm or corporation with whom County has entered into a Contract.

Days - All references to days are to be considered calendar days except as specified differently.

Defective - An adjective which when modifying the Work refers to work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to Project Representative's recommendation of final payment (unless responsibility for the protection thereof has been assumed by County).

Drawings - The drawings which show the character and Scope of Work to be performed and which have been prepared or approved by Engineer and are referred to in the Bid and Contract Documents.

Effective Date of the Contract - The date indicated in the Contract on which it becomes effective (date of execution).

Engineer – Licensed professional who is responsible for the preparation, signing, dating, sealing and issuing of any engineering document(s) for any engineering service or Work.

Excusable Delay - Any delay beyond the control and without the negligence of the Contractor, the County, or any other Contractor caused by events or circumstances such as, but not limited to, acts of God or of the public enemy, fires, floods, freight embargoes, acts of government other than County or epidemics. Labor disputes and above average rainfall shall give rise only to Excusable Delays.

Field Directive - A written order issued by an authorized County Representative which approves changes in the Work, but does not involve a change in the initial Scope of Work, including the Contract Price and the Contract Time. A Field Directive must be issued by an authorized County Representative to authorize use of Contract Contingency funds.

Final Completion – The Work (including items defined on the Punch List) has been completed, accepted in writing by the County, approved as-builts have been received, and is ready for final payment.

Float or Slack Time - The time available in the progress schedule during which an unexpected activity can be completed without delaying Substantial Completion of the Work.

Inexcusable Delay - Any delay caused by events or circumstances within the control of the Contractor, such as inadequate crewing, slow submittals, etc., which might have been avoided by the exercise of care, prudence, foresight, or diligence on the part of the Contractor.

Information (Pre-Bid) Conference – A meeting held by the Purchasing Division with potential Bidders, prior to the opening of the solicitation, for the purpose of answering questions, clarifying ambiguities, and responding to general issues in order to establish a common basis for understanding all of the requirements of the solicitation; may result in the issuance of an Addendum.

Material Breach – A substantial failure in the performance of the Contract, as to give the affected party the right to remedies available in the Contract.

Non-prejudicial Delay - Any delay impacting a portion of the Work within the available total Float or Slack Time and not necessarily preventing completion of the Work within the Contract Time.

Notice of Award - The written notice to the Successful Bidder stating Award has been approved by the Board of County Commissioners; or by the Purchasing Official in accordance with Chapter 2-26 of the Manatee County Code.

Notice of Intent to Award - The written notice to the apparent Successful Bidder stating Award has been recommended with final Award to be authorized by the Purchasing Official or Board of County Commissioners, as appropriate.

Notice to Proceed - Written notice by County (after execution of Contract) to Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform (ten (10) days from date of such notice) Contractor's obligations under the Contract Documents.

Payment Bond – An instrument, issued by a Surety that guarantees that Subcontractors will be paid for labor expended on the Contract.

Performance Bond – An instrument executed subsequent to Award by the successful Contractor that protects the County from loss due to Contractor’s inability to complete the Contract as agreed.

Preconstruction Conference - Prior to starting the Work, a meeting scheduled by County with Contractor to review the Work schedules, to establish procedures for handling Shop Drawings and other submissions, for processing periodical pay estimates, and such other matters as may be pertinent to the project.

Prejudicial Delay - Any excusable or Compensable Delay impacting the Work and exceeding the total float time available in the progress schedule, thus preventing completion of the Work within the Contract Time unless the Work is accelerated.

Pre-operation Testing - All field inspections, installation checks, water tests, performance tests and necessary corrections required of Contractor to demonstrate that individual components of the Work have been properly constructed and do operate in accordance with the Contract Documents for their intended purposes.

Project - The total construction of which the Work to be provided under the Contract Documents (may be the whole or a part as indicated elsewhere in the Contract Documents).

Project Representative - The authorized representative of Manatee County who is assigned to the project or any part thereof.

Punch List – A list of minor deficiencies or additional Work that does not prohibit achieving Substantial Completion yet must be completed before Final Completion of the Contract can be achieved.

Retainage – A certain percentage, identified in the solicitation document, is withheld from payment due to the Contractor until the Work is fully completed and accepted by County.

Schedule of Values – In the case of a total, lump sum Bid, unit prices shall be established for this Contract by the submission of a Schedule of Values. In the case of an itemized Bid, unit prices are the prices bid. The Contractor shall submit a Schedule of Values within ten (10) days of Notice to Proceed date. The schedule shall include quantities and prices of items equaling the Total Offer and will subdivide the Work into components in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work. Upon request of the County, the Contractor shall support the values with data which will substantiate their correctness.

Shop Drawings - All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by Contractor to illustrate material or equipment for some portion of the Work.

Special Provisions: As required to define Work or procedures not covered in the standard Specifications, and as necessary to supplement or modify items in the standard Specifications.

Subcontractor - An individual or corporation having a direct contact with Contractor or with any other Subcontractor for the performance of a part of the Work at the site. Such person or firm has contractual relations with the Contractor, not with the County.

Substantial Completion - The stage in the progress of the Work (or a specified portion thereof) is sufficiently complete in accordance with the Contract Documents so the Work (or a specified portion thereof) can be utilized for the intended purpose.

Successful Bidder - The lowest, responsible and responsive Bidder to whom an Award is made.

Supplier - A manufacturer, fabricator, Supplier, distributor, material man or vendor.

Surety – A pledge or guarantee by an insurance company, bank, individual or corporation on behalf of the Bidder which protects against default or failure of the principal to satisfy the contractual obligations.

Underground Facilities - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments and any encasement containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

Unit Price Work - Work to be paid for on the basis of unit prices.

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

Work Directive Change - A written directive to Contractor, issued on or after the Effective Date of the Contract and signed by County and recommended by Project Representative ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed or to emergencies. A Work Directive Change itself may not change the Contract Price or Contract Time; but is evidence that the parties expect that the change directed or documented by a Work Directive Change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Time.

Written Amendment - A Written Amendment of the Contract Documents, signed by County and Contractor on or after the Effective Date of the Contract and normally dealing with the non-engineering or non-technical rather than strictly Work related aspects of the Contract Documents.

ARTICLE 2. PRELIMINARY MATTERS

Computation of Time: When time is referred to in the Contract Documents 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 legal holiday, such day will be omitted from the computation.

2.1 The Contractor must submit a proposed schedule of the Work at the Preconstruction Conference. The purpose of this schedule is to enable the County to govern the Work, to protect the functions of the local government and its citizens and to aid in providing appropriate surveillance. The County shall have the right to reschedule Work provided such rescheduling is in accordance with the remainder of the terms of the Contract. The schedule shall show, as a minimum, the approximate dates on which each segment of the Work is expected to be started and finished, the proposed traffic flows during each month, the anticipated earnings by the Contractor for each month and the approximate number of crews and equipment to be used. The County, after necessary rescheduling and obtaining additional information for specific

purposes, shall review and approve the schedule. The Contractor shall also forward to the County, as soon as practicable after the first day of each month, a summary report of the progress of the various parts of the Work under the Contract, in fabrication and in the field, stating the existing status, estimated time of completion and cause of delay, if any. Together with the summary report, the Contractor shall submit any necessary revisions to the original schedule for the County's review and approval. In addition, more detailed schedules may be required by the County for daily traffic control.

2.2 A Notice to Proceed may be given at any time within thirty (30) days after the Effective Date of the Contract. The Contract Time will commence at the time specified in such notice. Contractor shall start to perform the Work on the date specified in the Notice to Proceed, but no Work shall be done at the site prior to the date on which the Contract Time commences to run.

2.3 If at any time the materials and appliances to be used appear to the County as insufficient or improper for securing the quality of Work required or the required rate of progress, the County may order the Contractor to increase his efficiency or to improve the character of his Work and the Contractor shall conform to such an order. The failure of the County to demand any increase of such efficiency of any improvement shall not release the County from its obligation to secure the quality of Work or the rate of progress necessary to complete the Work within the limits imposed by the Contract. The County may require the Contractor to remove from the Work such employees as the County deems incompetent, careless, insubordinate or otherwise objectionable, or whose continued employment on the Work is deemed to be contrary to the County's interest.

2.4 The County reserves the right to let other Contracts in connection with this Work. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and execution of their Work, and promptly connect and coordinate the Work with theirs.

ARTICLE 3. CONTRACT DOCUMENTS: INTENT, AMENDING, RE-USE

3.1 The Contract Documents comprise the entire Contract between County and Contractor concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the laws and ordinances of the State of Florida and Manatee County.

Should a conflict exist within the Contract Documents, the precedence in order of authority is as follows: 1) Bid Summary, 2) Special Conditions, 3) General Conditions, and 4) Drawings.

Note: Computed dimensions shall govern over scaled dimensions.

3.2 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. Any work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called for in the Contract Documents. When words which have a well-known technical or trade meaning are used to describe Work, materials, or equipment, such words shall be interpreted in accordance with that meaning. Reference to standard Specifications, manuals or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or laws or regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of County, Contractor or Engineer, or any of their agents or employees from those set forth in the Contract Documents.

3.3 The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

3.3.1 A Written Amendment

3.3.2 A Change Order

3.3.3 An Administrative Contract Adjustment (ACA)

3.3.4 A Work Directive Change

3.4 In addition, the requirements of the Contract Documents may be supplemented and minor variations and deviations in the Work may be authorized in one or more of the following ways:

3.4.1 Contract Contingency Work – Field Directive

3.4.2 Engineer's approval of a Shop Drawing or sample

ARTICLE 4. CONTRACTOR'S RESPONSIBILITIES

4.1 Contractor shall keep on the Work at all times during its progress a competent resident superintendent; who shall be the Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications given to the superintendent shall be as binding as if given to Contractor.

4.2 Contractor shall provide competent, suitable 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. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours and Contractor will not permit overtime Work or the performance of Work on Saturday, Sunday or legal holiday without County's written consent given after prior notice to Engineer (at least seventy-two (72) hours in advance).

4.2.1 Contractor shall pay for all additional engineering charges to the County for any overtime Work which may be authorized. Such additional engineering charges shall be a subsidiary obligation of Contractor and no extra payment shall be made by County on account of such overtime Work. At County's option, overtime costs may be deducted from Contractor's monthly payment request or Contractor's Retainage prior to release of final payment.

4.3 Unless otherwise specified, Contractor shall furnish and assume full responsibility for all bonds, insurance, 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 furnishing, performance, testing, start-up and completion of the Work.

4.4 All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instruction of the applicable Supplier except as otherwise provided in the Contract Documents.

4.5 Contractor shall be fully responsible to County for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect Contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create any contractual relationship between County or Engineer and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of County to pay or to see to the payment of any monies due any such Subcontractor, Supplier or other person or organization.

4.6 Permits: Unless otherwise provided, Contractor shall obtain and pay for all construction permits and licenses. County 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.

4.7 During the progress of the Work, Contractor shall keep the premises free from accumulation of waste materials rubbish and other debris resulting from the Work. At the completion of the Work, Contractor shall remove all waste materials, rubbish, and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials and shall leave the site clean and ready for occupancy by County. Contractor shall restore to original conditions all property not designated for alteration by the Contract Documents.

4.8 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 property to stresses or pressures that will endanger it.

4.9 Safety and Protection: Contractor shall comply with the Florida Department of Commerce Safety Regulations and any local safety regulations. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

4.9.1 all employees on the Work and other persons and organizations who may be affected thereby;

4.9.2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

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

4.9.4 Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall provide and maintain all passageways, guard fences, lights and other facilities for the protection required by public authority or local conditions. Contractor shall provide reasonable maintenance of traffic way for the public and preservation of the County’s business, taking into full consideration all local conditions. Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed.

4.10 Emergencies: In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, without special instruction or authorization from Engineer or County, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give County prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If County determines that a change in the Contract Documents is required because of the action taken in response to an emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variation.

4.11 For substitutes not included with the Bid, but submitted after the Effective Date of the Contract, Contractor shall make written application to Engineer for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will also contain an itemized estimate of all costs and delays or schedule impacts that will result directly or indirectly from review, acceptance and provisions of such substitute, including costs of redesign and claims of other Contractors affected by the resulting change, all of which will be considered by the Engineer in evaluating the proposed substitute. Engineer may require Contractor to furnish at Contractor's expense, additional data about the proposed substitute. In rendering a decision, County/Engineer and Contractor shall have access to any available Float or Slack Time in the construction schedule. In the event that substitute materials or equipment not included as part of the Bid, but proposed after the Effective Date of the Contract, are accepted and are less costly than the originally specified materials or equipment, then the net difference in cost shall be credited to the County and an appropriate Change Order executed.

4.11.1 If a specific means, method, sequence, technique or procedure of construction is indicated in or required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to Engineer if Contractor submits sufficient information to allow Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents.

4.11.2 Engineer will be allowed a reasonable time within which to evaluate each proposed substitute. Engineer will be the sole judge of acceptability and no substitute will be ordered, installed or utilized without Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved shop drawing. County may require Contractor to furnish at Contractor's expense a special performance guarantee or other Surety with respect to any substitute.

4.11.3 Contractor shall reimburse County for the charges of Engineer and Engineer's consultants for evaluating each proposed substitute submitted after the Effective Date of the Contract and all costs resulting from any delays in the Work while the substitute was undergoing review.

4.12 The Contractor shall furnish, free of charge, all labor, stakes, surveys, batter boards for structures, grade lines and other materials and supplies and shall set construction stakes and batter boards for establishing lines, position of structures, slopes and other controlling points necessary for the proper prosecution of the construction Work. Where rights-of-way, easements, property lines or any other conditions which make the lay-out of the project or parts of the project critical are involved, the Contractor will employ a competent surveyor who is registered in the State of Florida for lay-out and staking. These stakes and marks shall constitute the field control by and in accord with which the Contractor shall govern and execute the Work. The Contractor will be held responsible for the preservation of all stakes, marks and if for any reason any of the stakes or marks or batter boards become destroyed or disturbed, they will be immediately and accurately replaced by the Contractor.

4.13 The Contractor has, by careful examination, satisfied himself as to the nature and location of the Work and all other matters which can in any way affect the Work under this Contract, including, but not limited to details pertaining to boring, as shown on the drawings, are not guaranteed to be more than a general indication of the materials likely to be found adjacent to holes bored at the site of the Work, approximately at the locations indicated. The Contractor shall examine boring data, where available, and make his own interpretation of the subsoil investigations and other preliminary data, and shall base his Bid on his own opinion of the conditions likely to be encountered. In no event shall an extension of time be considered for any conditions that existed at the time of bidding, nor shall the Contractor receive extra compensation for completion of the project as intended by the drawings and in keeping with the Contact documents. No verbal agreement or conversation with any officer, agent or employee of the County, before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.

4.14 If the Contractor, in the course of the Work, finds that the drawings and/or Contract Documents cannot be followed, he shall immediately inform the County in writing, and the County shall promptly check the accuracy of the information. Any Work done after such discovery, until any necessary changes are authorized, will be done at the Contractor's risk.

ARTICLE 5. COUNTY'S RESPONSIBILITIES

5.1 County shall furnish the data required of County under the Contract Documents promptly and shall make payments to the Contractor within a reasonable time after the Work has been accepted by the County. Payment shall be made no more than twenty (20) business days if County is its own Engineer of Record or twenty-five (25) business days if outside agent approval is required after the pay estimate has been approved by the agent for the County. The form of all submittals, notices, Change Orders and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the County/Engineer. Standard County forms shall be utilized.

5.2 The County shall provide the lands upon which the Work under this Contract is to be done, except that the Contractor shall provide all necessary additional land required for the erection of temporary construction facilities and storage of his materials, together with right of access to same.

5.3 The County shall have the right to take possession of and use any completed portions of the Work, although the time for completing the entire Work or such portions may not have expired, but such taking possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.

ARTICLE 6. CHANGES IN THE WORK

6.1 Without invalidating the Contract and without notice to any Surety, County may, at any time, order additions, deletions or revisions in the Work. These will be authorized by a Written Amendment, a Change Order, or a Work Directive Change. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

6.2 Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented.

6.3 County and Contractor shall execute appropriate Change Orders, or Written Amendments, covering changes in the Work which are ordered by County, or which may be required because of acceptance of defective Work.

6.4 At any time Engineer may request a quotation from Contractor for a proposed change in the Work and within twenty-one (21) calendar days after receipt, Contractor shall submit a written and detailed proposal for an increase or decrease in the Contract Price or Contract Time for the proposed change. Engineer shall have twenty-one (21) calendar days after receipt of the detailed proposal to respond in writing. The proposal shall include an itemized estimate of all costs and time for performance that will result directly or indirectly from the proposed change. Unless otherwise directed, itemized estimates shall be in

sufficient detail to reasonably permit an analysis by Engineer of all material, labor, equipment, subcontracts, overhead costs and fees, and shall cover all Work involved in the change, whether such Work was deleted, added, changed or impacted. Notwithstanding the Request for Quotation, Contractor shall carry on the Work and maintain the progress schedule. Delays in the submittal of the written and detailed proposal will be considered non-prejudicial.

ARTICLE 7. CHANGE OF CONTRACT PRICE

7.1 The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at his expense without change in the Contract Price.

7.2 The Contract Price may only be changed by Change Order or by a Written Amendment. Any claim for an increase or decrease in the Contract Price shall be based on written notice delivered by the party making the claim to the other party. Notice of the amount of the claim with supporting data shall be delivered within ten (10) days from the beginning of such occurrence and shall be accompanied by claimant's written statement that the amount claimed covers all known amounts (direct, indirect and consequential) to which the claimant is entitled as a result of the occurrence of said event.

7.3 The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways, at the County’s discretion:

7.3.1 Where the Work involved is covered by unit prices contained in the Contract Documents, cost will be determined by application of such unit prices to the quantities of the items involved.

7.3.2 By mutual acceptance of lump sum.

7.3.3 On the basis of the cost of the Work, plus a 15% Contractor's fee for overhead and profit. (Contractor shall submit an itemized cost breakdown together with supporting data.)

7.4 Either County or Contractor may make a claim for an adjustment in the Contract Price. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment under the following conditions:

7.4.1 If the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Price and the variation in the quantity of the particular item of Unit Price Work performed by Contractor differs by more than 15% from the estimated quantity of such item indicated in the Contract; and

7.4.2 If there is no corresponding adjustment with respect to any other item of Work; and

7.4.3 If a Contractor believes that it has incurred additional expense as a result thereof; or

7.4.4 If County believes that the quantity variation entitles it to an adjustment in the unit price; or

7.4.5 If the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

ARTICLE 8. CHANGE OF CONTRACT TIME

8.1 Contract Time may only be changed by a Change Order or a Written Amendment. Any claim for an extension or shortening of the Contract Time shall be based on written notice delivered by the party making the claim to the other party. Notice of the extent of the claim with supporting data shall be delivered within fifteen (15) days from detection or beginning of such occurrence and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event.

8.2 The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of Contractor. Such delays shall include, but not be limited to, acts or neglect by County or others performing additional Work; or to fires, floods, epidemics, abnormal weather conditions or acts of God.

8.3 All time limits stated in the Contract Documents are of the essence.

ARTICLE 9. WARRANTY, TEST/INSPECTION, CORRECTION

9.1 Contractor warrants, for a minimum period of three (3) years or as otherwise stated herein, and guarantees to County that all Work will be in accordance with the Contract Documents and will not be defective; that County, representatives of County, and governmental agencies with jurisdictional interests will have access to the Work at reasonable time for their observation, inspecting and testing (Contractor shall give Engineer timely notice of readiness of the Work for all required approvals and shall assume full responsibility, including costs, in obtaining required tests, inspections, and approval certifications and/or acceptance, unless otherwise stated by County).

9.2 If any Work (including work of others) that is to be inspected, tested, or approved is covered without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice. Neither observations by

Engineer nor inspections, tests, or approvals by others shall relieve Contractor from Contractor's obligations to perform the Work in accordance with the Contract Documents.

9.3 If the Work is defective, or Contractor fails to supply sufficient skilled workers, or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, County may order Contractor to stop the Work, or any portion thereof and terminate payments to the Contractor until the cause for such order has been eliminated. Contractor shall bear all direct, indirect and consequential costs for satisfactory reconstruction or removal and replacement with non-defective Work, including, but not limited to fees and charges of engineers, architects, attorneys and other professionals and any additional expenses experienced by County due to delays to other Contractors performing additional Work and an appropriate deductive Change Order shall be issued. Contractor shall further bear the responsibility for maintaining schedule and shall not be entitled to an extension of the Contract Time and the recovery of delay damages due to correcting or removing defective Work.

9.3.1 If Contractor fails within seven (7) days after written notice to correct defective Work, or fails to perform the Work in accordance with the Contract Documents, or fails to comply with any other provision of the Contract Documents, County may correct and remedy any such deficiency to the extent necessary to complete corrective and remedial action. County may exclude Contractor from all or part of the site, take possession of all or part of the Work, Contractor's tools, construction equipment and machinery at the site or for which County has paid Contractor but which are stored elsewhere. All direct and indirect costs of County in exercising such rights and remedies will be charged against Contractor in an amount approved as to reasonableness by Engineer and a Change Order will be issued incorporating the necessary revisions.

9.3.2 If within three (3) years after the date of completion or such longer period of time as may be prescribed by laws or regulations or by the terms of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to County and in accordance with County’s written instructions, either correct such defective Work or if it has been rejected by County, remove it from the site and replace it with non-defective Work. If Contractor does not promptly comply with the terms of such instruction, County may have the defective Work corrected or removed and all direct, indirect and consequential costs of such removal and replacement will be paid by Contractor.

ARTICLE 10. SUSPENSION OR TERMINATION OF WORK

10.1 County reserves the right to suspend the Work, or any portion thereof, at any time without cause for a period not to exceed ninety (90) days by written notice to Contractor, which will fix the date on which Work will be resumed. Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if Contractor makes an approved claim therefore.

10.1.1 If Work is suspended by County for a period that exceeds ninety (90) days; or if Work is suspended by an order of court or other public authority; or if County fails to pay Contractor, then Contractor may, upon seven (7) days written notice to County, terminate the Contract and recover payment for all Work executed.

10.1.2 In lieu of terminating the Contract, if the Engineer has failed to act on any Application for Payment or County has failed to make any payment as aforesaid, Contractor may, upon seven (7) days written notice to County, stop the Work until payment of all amounts then due have been received.

10.2 County reserves the right, after giving seven (7) days written notice, to terminate this Contract if:

10.2.1 Contractor persistently fails to perform the Work in accordance with the Contract Documents;

10.2.2 Contractor disregards laws or regulations of any public body having jurisdiction;

10.2.3 Contractor commences a voluntary case under any chapter of the Bankruptcy Code or any similar action by filing a petition under any other federal or state law relating to bankruptcy or insolvency;

10.2.4 Contractor has a petition filed against them under any chapter of the Bankruptcy Code or similar relief under any other federal or state law;

10.3 County may exclude Contractor from the site and take possession of the Work and of all Contractor's tools, construction equipment and machinery at the site and use same to the full extent they could be used (without liability to Contractor for trespass or conversion); incorporate in the Work all materials and equipment stored at the site or for which County has paid Contractor but which are stored elsewhere, and finish the Work as County may deem expedient.

10.3.1 Contractor shall not be entitled to receive any further payment beyond an amount equal to the value of material and equipment not incorporated in the Work, but delivered and suitably stored, less the aggregate of payments previously made.

10.3.2 If the direct, indirect and consequential costs of completing the Work exceed the unpaid balance of the Contract Price, Contractor shall pay the difference to County. Such costs incurred by County shall be verified by County and incorporated in a Change Order; but in finishing the Work, County shall not be required to obtain the lowest figure for the Work performed. Contractor's obligations to pay the difference between such costs and such unpaid balance shall survive termination of this Contract.

10.4 In the event sufficient budgeted funds are not available for a new fiscal year, County shall notify Contractor of such occurrence and Contract shall terminate on the last day of the current fiscal year without penalty or expense to County.

10.5 Failure of Contractor to comply with any of the provisions of this Contract shall be considered a Material Breach of Contract and shall be cause for immediate termination of Contract at the discretion of County.

10.6 In addition to all other legal remedies available to County, County reserves the right to terminate and obtain from another source, any commodities or services which have not been delivered within the Contract Time as stated in the Contract Documents.

ARTICLE 11. CONTRACT CLAIMS & DISPUTES

11.1 Except as otherwise provided herein, any dispute arising under this Contract shall be decided by the Purchasing Official in accordance with Section 2-26-63 of the Manatee County Code subject to an administrative hearing process provided in 2-26-64. The decision of the Board of County Commissioners in accordance with Section 2-26-64 of the Manatee County Code shall be the final and conclusive County decision subject to exclusive judicial review in the circuit court by a petition for certiorari.

ARTICLE 12. RESIDENT PROJECT REPRESENTATIVE - DUTIES, RESPONSIBILITIES

12.1 The Resident Project Representative is the Engineer’s Agent, who will act as directed by and under the supervision of the Engineer, and who will confer with County regarding his actions. Resident Project Representative's dealing in matters pertaining to the on-site Work shall, in general, be only with the County and Contractor and dealings with Subcontractors shall only be through or with the full knowledge of Contractor.

12.2 Resident Project Representative will:

12.2.1 Review the progress schedule, schedule of shop drawing submissions and Schedule of Values prepared by Contractor and consult with County concerning their acceptability.

12.2.2 Attend Preconstruction Conferences. Arrange a schedule of progress meetings and other job conferences as required in consultation with County and notify those expected to attend in advance. Attend meetings and maintain and circulate copies of minutes thereof.

12.2.3 Serve as County's liaison with Contractor, working principally through Contractor's superintendent and assist him in understanding the intent of the Contract Documents. As requested by Contractor, assist in obtaining additional details or information when required at the job site for proper execution of the Work.

12.2.4 Receive and record date of receipt of Shop Drawings and samples, receive samples which are furnished at the site by Contractor and notify Engineer of their availability for examination.

12.2.5 Advise Engineer and Contractor or his superintendent immediately of the commencement of any Work requiring a shop drawing or sample submission if the submission has not been approved by the County.

12.2.6 Conduct on-site observations of the Work in progress to assist Engineer in determining if the Work is proceeding in accordance with the Contract Documents and that completed Work will conform to the Contract Documents.

12.2.7 Report to County whenever he or she believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or does not meet the requirements of any inspections, tests or approvals required or if Work has been damaged prior to final payment; and advise Contractor when he believes Work should be corrected or rejected or should be uncovered of observation or requires special testing, inspection or approval.

12.2.8 Verify that tests, equipment and system start-ups and operating and maintenance instructions are conducted as required by the Contract Documents and in the presence of the required personnel, and that Contractor maintains adequate records thereof; observe, record and report to Engineer appropriate details relative to the test procedures and start-ups.

12.2.9 Accompany visiting inspectors representing public or other agencies having jurisdiction over the project; record the outcome of these inspections and report to County.

12.2.10 Transmit to Contractor, Engineer's clarifications and interpretations of the Contract Documents.

12.2.11 Consider and evaluate Contractor's suggestions or modifications in drawings or Contract Documents and report them with recommendations to County.

12.2.12 Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and sample submissions, reproductions of original Contract Documents including all Addenda, Change Orders, field orders, additional drawings issued subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports and other project related documents.

12.2.13 Keep a diary or log book, recording hours on the job site, weather conditions, data relative to questions of extras or deductions; list of visiting officials and representatives or manufacturers, fabricators, Suppliers and distributors; daily activities, decisions, observations in general and specific observations in more detail as in the case of observing test procedures. Send copies to County.

12.2.14 Record names, addresses and telephone numbers of all Contractors, Subcontractors and major Suppliers of materials and equipment.

12.2.15 Furnish Engineer periodic reports as required of progress of the Work and Contractor's compliance with the approved progress schedule and schedule of shop drawing submissions.

12.2.16 Consult with Engineer in advance of scheduling major tests, inspections or start of important phases of the Work.

12.2.17 Report immediately the occurrence of any accident.

12.2.18 Review applications for payment with Contractor for compliance with the established procedure for their submission and forward them with recommendations to Engineer, noting particularly their relation to the Schedule of Values, Work completed and materials and equipment delivered at the site but not incorporated in the Work.

12.2.19 During the course of the Work, verify that certificates, maintenance and operations manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed, and deliver this material to County for his review prior to final acceptance of the Work.

12.2.20 Before Engineer issues a certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.

12.2.21 Conduct final inspection in the company of County and/or Engineer and Contractor and prepare a Punch List of items to be completed or corrected. Reference Florida Statutes § 218.735(7).

12.2.22 Verify that all items on final list have been completed or corrected and make recommendations to County concerning acceptance.

12.3 Except upon written instructions of Engineer, Resident Project Representative:

12.3.1 Shall not authorize any deviation from the Contract Documents or approve any substitute materials or equipment;

12.3.2 Shall not exceed limitations on Engineer's authority as set forth in the Contract Documents;

12.3.3 Shall not undertake any of the responsibilities of Contractor, Subcontractors or Contractor's superintendent, or expedite the Work;

12.3.4 Shall not advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract Documents;

12.3.5 Shall not advise on or issue directions as to safety precautions and programs in connection with the Work;

12.3.6 Shall not authorize County to occupy the project in whole or in part; and

12.3.7 Shall not participate in specialized field or laboratory tests.

ARTICLE 13. APPRENTICES

13.1 If successful Contractor employs apprentices, he shall be governed and comply with the provisions of Fla.Stat. § 446.011.

NOTE: The form of all submittals, notices, Change Orders and other documents permitted or required to be used or transmitted under the Contract shall be determined by the County. Standard County forms shall be utilized.

END OF SECTION E

SECTION F

FORM OF CONTRACT
BETWEEN THE
COUNTY OF MANATEE, FLORIDA
AND CONTRACTOR AS IDENTIFIED BELOW
ON THE BASIS OF A STIPULATED UNIT COST CONTRACT PRICE

This CONTRACT is made and entered into by and between the COUNTY OF MANATEE, a political subdivision of the State of Florida, hereinafter referred to as "COUNTY" and **XXXXXXXXXX**, hereinafter referred to as "CONTRACTOR," duly authorized to transact business in the State of Florida, with offices located at **XXXXXXXXXX**.

ARTICLE 1. WORK

CONTRACTOR shall furnish all labor, materials, supplies, and other items required to complete the Work for **IFB #14-0667CD- Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility** in strict accordance with Contract Documents and any duly authorized subsequent Addenda thereto, all of which are made a part hereof.

ARTICLE 2. COMPENSATION

As compensation to CONTRACTOR, COUNTY shall pay and CONTRACTOR will accept as full consideration for the performance of all Work required by **IFB #14-0667CD- Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility**, subject to additions and deductions as provided therein, the sum of **$xxx.xx** for Bid "**XX**" based on a completion time of **XXX** calendar days.

ARTICLE 3. LIQUIDATED DAMAGES

Time is of the essence in this CONTRACT. As of the date of this CONTRACT, the damages that will be suffered by COUNTY in the event of CONTRACTOR'S failure to timely complete the Work are impossible to determine. In lieu thereof, it is agreed that if CONTRACTOR fails to achieve Final Completion of the Work within XXX calendar days of issuance of the Notice to Proceed (accounting, however, for any extensions of time granted pursuant to approved Change Orders), CONTRACTOR shall pay to COUNTY,

as liquidated damages (and not as a penalty), the sum of $1,532 per calendar day for each day beyond XXX days until CONTRACTOR achieves Final Completion. COUNTY shall have the option of withholding said liquidated damages from any pay application(s) thereafter submitted by CONTRACTOR. Alternatively, CONTRACTOR shall immediately pay said sums to COUNTY upon COUNTY'S demand for same.

ARTICLE 4. ENGINEER

The COUNTY of MANATEE, Public Works Department, is responsible as COUNTY and Stantec Consulting Services Inc. as "ENGINEER," designed this Project and is responsible for technical/engineering reviews and decisions. The ENGINEER is a member of COUNTY'S Project Management team which is collectively responsible for ensuring the Work is completed in accordance with the Contract Documents.

All communications involving this Project will be addressed to: Anthony Benitez, PE, Project Engineer II, Public Works Department and to the Engineer of Record, Robert J. Halbach, PE, Stantec Consulting Services Inc. All invoicing will be addressed to the attention of: Anthony Benitez, PE (address noted below) with invoice copies sent to Robert J. Halbach, PE, Stantec Consulting Services Inc. (address noted below).

Manatee County Public Works Dept.
IFB# 14-0667CD
Attention: Anthony Benitez, PE
Project Engineer II
1022 26th Avenue East
Bradenton, Florida 34208
Phone (941) 708-7450 ext. 7333

Stantec Consulting Services Inc.
IFB# 14-0667CD
Attn: Robert J. Halbach, PE
Project Manager
5172 Station Way
Sarasota, Florida 34233
Phone (941) 365-5500

Where the terms ENGINEER and/or COUNTY are used in the Contract Documents, it shall mean COUNTY'S Project Management team.

ARTICLE 5. CONTRACTOR'S REPRESENTATIONS

In order to induce COUNTY to enter into this CONTRACT, CONTRACTOR makes the following representations:

5.1 CONTRACTOR has familiarized itself with the nature and extent of the Bid Documents, Work, site, locality and all local conditions and laws and regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

5.2 CONTRACTOR has studied carefully all drawings of the physical conditions upon which CONTRACTOR is entitled to rely.

5.3 CONTRACTOR has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, reports and studies which pertain to the physical conditions at or contiguous to the site or which otherwise may affect the cost, progress, performance or furnishing of the Work as CONTRACTOR considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Bid Documents; and no additional examinations, investigations, explorations, tests, reports, studies or similar information or data are or will be required by CONTRACTOR for such purposes.

5.4 CONTRACTOR has reviewed and checked all information and data shown or indicated on the Bid Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities. Any additional examinations, investigations, explorations, tests, reports, studies or similar information or data in respect of said Underground Facilities conducted by CONTRACTOR will be done at CONTRACTOR'S expense.

5.5 CONTRACTOR has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Bid.

5.6 CONTRACTOR has given COUNTY written notice of all conflicts, errors or discrepancies that have been discovered in the Bid Documents and the written resolution thereof by COUNTY is acceptable to CONTRACTOR.

5.7 CONTRACTOR shall schedule and perform the Work subject to COUNTY'S approval and shall hold COUNTY harmless from all liabilities incurred due to CONTRACTOR'S failure to coordinate with COUNTY.

ARTICLE 6. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire CONTRACT between COUNTY and CONTRACTOR concerning the Work consist of the following:

6.1 This CONTRACT and Bid Document **IFB # 14-0667CD**

6.2 Invitation for Bid #14-0667CD, in its entirety

6.3 Public Construction Bond Form and Insurance Certificate(s)

6.4 Drawings/Plans (not attached)

6.5 Addendum number xx to xx inclusive

6.6 CONTRACTOR'S Bid Form

6.7 Reports

6.8 The following, which may be delivered or issued after the Effective Date of the CONTRACT and are not attached hereto: all written Change Orders and other documents amending, modifying, or supplementing the Contract Documents.

6.9 The documents listed in paragraphs above are attached to this CONTRACT (except as noted otherwise above). There are no Contract Documents other than those listed above in this Article 6.

ARTICLE 7. DISPUTE RESOLUTION

Disputes shall be resolved as follows: good faith negotiations by the designated agents of the parties and if not resolved by such designated agents, CONTRACTOR shall submit its claim, with the basis for the dispute, in writing to the Manatee County Purchasing Official for a determination and handling in accordance with the provisions of Chapter 2-26 of the Manatee County Code.

ARTICLE 8. NO WAIVER

8.1 The failure of CONTRACTOR or COUNTY to insist on the strict performance of the terms and conditions hereof shall not constitute or be construed as a waiver or relinquishment of either party's right to thereafter enforce the same in accordance with this CONTRACT in the event of a continuing or subsequent default on the part of CONTRACTOR or COUNTY.

8.2 Nothing herein shall be interpreted as a waiver of COUNTY of its rights, including the limitations of the limited waiver of sovereign immunity, as set forth in Florida Statute 768.28, or any other statute, and COUNTY expressly reserves these rights to the full extent allowed by law.

ARTICLE 9. NO THIRD-PARTY BENEFICIARIES

This CONTRACT is solely for the benefit of the parties hereto, and no right, privilege, or cause of action shall by reason hereof accrue upon, to, or for the benefit of any third party. Nothing in this CONTRACT is intended or shall be construed to confer upon or give any person, corporation, partnership, trust, private entity, agency, or any other governmental entity any right, privilege, remedy, or claim under or by reason of this CONTRACT or any provisions or conditions hereof.

ARTICLE 10. GOVERNING LAW, JURISDICTION AND VENUE

10.1 This CONTRACT and the construction and enforceability thereof shall be interpreted under the laws of the State of Florida.

10.2 CONTRACTOR consents and agrees that all legal proceedings related to the subject matter of this CONTRACT shall be governed by the laws of and maintained in courts sitting with the State of Florida.

10.3 CONTRACTOR consents and agrees that jurisdiction for such proceedings shall lie exclusively with such court and venue in Manatee County, Florida, or if in Federal Court, the Middle District of Florida, Tampa Division.

10.4 In the event of any litigation arising under the terms of this CONTRACT, each party shall be responsible for their own attorney's fees, including appellate fees, regardless of the outcome of the litigation.

ARTICLE 11. FORCE MAJEURE

Neither party shall be considered in default of performance of such obligations hereunder to the extent that performance of such obligations or any of them is delayed or prevented by Force Majeure. Force Majeure shall include, but not be limited to hostility, revolution, civil commotion, strike, epidemic, fire, flood, wind, earthquake, hurricane, or other disruptive event of nature, act of terrorism, explosion, lack of or failure of transportation or bridge/roadway facilities, any law, proclamation, regulation, ordinance or other act of government, or any act of God or any cause whether of the same or different nature, existing or future; provided that the cause, whether or not enumerated in this Article, is beyond the control and without the fault or negligence of the party seeking relief under this Article.

ARTICLE 12. MISCELLANEOUS

12.1 Terms used in this CONTRACT are defined in Article 1 of Section E, General Conditions.

12.2 No assignment by a party hereto of any rights under or interest in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation, monies that may become due and monies 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 assignee from any duty or responsibility under the Contract Documents.

12.3 COUNTY 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 of all covenants, agreements, and obligations contained in the Contract Documents.

12.4 By accepting Award of this CONTRACT, CONTRACTOR, which shall include its directors, officers and employees, represents that it presently has no interest in and shall acquire no interest in any business or activity which would conflict in any manner with the performance of duties or services required hereunder.

CONTRACT

IFB #14-0667CD

IN WITNESS WHEREOF, the parties hereto have caused this CONTRACT **14-0667CD** to be duly executed by their authorized representatives.

CONTRACTOR

By: _____

_____
Print Name & Title of Signer

Date: _____

COUNTY OF MANATEE, FLORIDA

By: _____
Melissa M. Wendel, CPPO
Purchasing Official

Date: _____

MANATEE COUNTY GOVERNMENT
PUBLIC CONSTRUCTION BOND

Bond No. _____
(Enter bond number)

BY THIS BOND, We_____, located at _____, as
(Name of Contractor) (Address)

Principal and _____, a corporation, whose address is
(Name of Surety)

_____

are bound to Manatee County, a political subdivision of the State of Florida, herein called County, in the sum of $ _____, for payment of which we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally.

WHEREAS, the Contractor has entered into Contract No. 14-0667CD with the County for the project titled Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility, with conditions and provisions as are further described in the aforementioned Contract, which Contract is by reference made a part hereof for the purposes of explaining this bond.

THE CONDITION OF THIS BOND is that if Principal:

1.# Performs Contract No. 14-0667CD, between Principal and County for construction of

Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility, the Contract being made a part of this bond by reference, at
(Title of Project)

the times and in the manner prescribed in the Contract; and

2.# Promptly makes payments to all claimants, as defined in Section 255.05(1), Florida Statutes, supplying Principal with labor, materials, or supplies, used directly or indirectly by Principal in the prosecution of the Work provided for in the Contract; and

3.# Pays County all losses, damages, expenses, costs, and attorney's fees, including appellate proceedings, that County sustains because of a default by Principal under the Contract; and

4.# Performs the guarantee of all Work and materials furnished under the Contract for the time specified in the Contract, then this bond is void; otherwise it remains in full force.

Any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05(2), Florida Statutes.

Any changes in or under the Contract documents and compliance or noncompliance with any formalities connected with the Contract or the changes does not affect Surety's obligation under this bond.

DATED ON _____.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____	_____
Company Name	Company Name
_____	_____
Signature	Signature
_____	_____
Print Name & Title	Print Name & Title
(Corporate Seal)	*(Corporate Seal)*

AGENT or **BROKER**

Company Name

Address

Telephone

Licensed Florida Insurance Agent? ☐ **Yes** ☐ **No**

License #: _____

State of: _____

County of: _____

City of: _____

BID FORM

(Submit in triplicate)

For: IFB #14-0667CD- Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility

Total Offer (Bid "A"): _____
Based on a completion time of 300 calendar days
Total Offer (Bid "B"): _____
Based on a completion time of 365 calendar days

Two schedules for completion of the Work shall be considered. Each Bid for completion by the specified stated time shall be offered as a separate "total offer". County has the sole authority to select the Bid based on the completion time which is in the best interest of County. Only one Award shall be made.

We, the undersigned, hereby declare that we have carefully reviewed the Bid Documents and with full knowledge and understanding of the aforementioned herewith submit this Bid, meeting each and every specification, term, and condition contained in the Invitation for Bid package, in its entirety.

We understand that the Invitation for Bid package, in its entirety, including but not limited to, all Specifications, terms, and conditions shall be made a part of any resulting Contract between Manatee County and the Successful Bidder. Failure to comply shall result in Contract default, whereupon, the defaulting Contractor shall be required to pay for any and all re-procurement costs, damages, and attorney fees as incurred by County, and agrees to forfeit his/her Bid Bond.

Communications concerning this Bid shall be addressed as follows: **(Complete all fields)**

Bidder's Name: _____

Mailing Address: _____

Telephone: ( ) _____ Fax: ( ) _____

Email Address: _____

I, _____ attest that I have read, understand, and agree to the Local Preference policy of Manatee County.

I, _____ on [date(s)] **_____ attest that I have visited the Project site(s) to familiarize myself with the full Scope of Work required for the Bid.**

Acknowledge Addendum No.____ Dated: _____ Acknowledge Addendum No._____ Dated: _____
Acknowledge Addendum No.____ Dated: _____ Acknowledge Addendum No._____ Dated: _____
Acknowledge Addendum No.____ Dated: _____ Acknowledge Addendum No._____ Dated: _____

Authorized Signature(s): _____

Name and Title of Above Signer(s): _____

Date: _____

BID FORM

(Submit in Triplicate)

SLUDGE HOLDING TANK IMPROVEMENTS AT THE SOUTHEAST WATER RECLAMATION FACILITY

Bid "A" Based on Completion Time of 300 Calendar Days

ITEM NO.		DESCRIPTION	EST. QTY.	U/M	UNIT PRICE	EXTENDED PRICE
1		MOBILIZATION/ DEMOBILIZATION	1	LS	$	$
2		SLUDGE THICKENING EQUIPMENT				
	a	GRAVITY BELT THICKENER	1	LS	$	$
	b	THICKENED SLUDGE PUMP (PUMP NO. 8)	1	LS	$	$
	c	DUAL POLYMER FEED	1	LS	$	$
	d	SLUDGE TRANSFER PUMP NO. 5	1	LS	$	$
3		DIFFUSERS	480	EA	$	$
4		YARD PIPING	1	LS	$	$
5		VALVES (6-INCH AND LARGER)				
	a	6-INCH MANUAL PLUG VALVE	5	EA	$	$
	b	6-INCH MOTORIZED PLUG VALVE	1	EA	$	$
	c	8-INCH MANUAL PLUG VALVE	1	EA	$	$
	d	6- INCH CHECK VALVE	2	EA	$	$
6		STRUCTURES				
	a	ROOF STRUCTURE FOUNDATION AND THICKENER BASE SLAB	1	LS	$	$
	b	ROOF STRUCTURE	1	LS	$	$

Bidder Name: _____

Authorized Signature: _____

BID FORM

(Submit in Triplicate)

SLUDGE HOLDING TANK IMPROVEMENTS AT THE SOUTHEAST WATER RECLAMATION FACILITY

Bid "A" Based on Completion Time of 300 Calendar Days

ITEM NO.		DESCRIPTION	EST. QTY.	U/M	UNIT PRICE	EXTENDED PRICE
7		ELECTRICAL, INSTRUMENTATION AND CONTROLS				
	a	ELECTRICAL	1	LS	$	$
	b	INSTRUMENTATION AND CONTROLS	1	LS	$	$
8	a	REMOVE DEBRIS FROM SLUDGE HOLDING TANKS	1,000	CY	$	$
		TOTAL BASE BID "A" - Based on Completion Time of 300 Calendar Days				$
9		CONTRACT CONTINGENCY WORK (USED ONLY WITH COUNTY APPROVAL)		10% OF TOTAL BASE BID		$
		TOTAL OFFER FOR BID "A" with Contract Contingency - Based on Completion Time of 300 Calendar Days				$

Bidder Name: _____

Authorized Signature: _____

BID FORM

(Submit in Triplicate)

SLUDGE HOLDING TANK IMPROVEMENTS AT THE SOUTHEAST WATER RECLAMATION FACILITY

Bid "B" Based on Completion Time of 365 Calendar Days

ITEM NO.		DESCRIPTION	EST. QTY.	U/M	UNIT PRICE	EXTENDED PRICE
1		MOBILIZATION/ DEMOBILIZATION	1	LS	$	$
2		SLUDGE THICKENING EQUIPMENT				
	a	GRAVITY BELT THICKENER	1	LS	$	$
	b	THICKENED SLUDGE PUMP (PUMP NO. 8)	1	LS	$	$
	c	DUAL POLYMER FEED	1	LS	$	$
	d	SLUDGE TRANSFER PUMP NO. 5	1	LS	$	$
3		DIFFUSERS	480	EA	$	$
4		YARD PIPING	1	LS	$	$
5		VALVES (6-INCH AND LARGER)				
	a	6-INCH MANUAL PLUG VALVE	5	EA	$	$
	b	6-INCH MOTORIZED PLUG VALVE	1	EA	$	$
	c	8-INCH MANUAL PLUG VALVE	1	EA	$	$
	d	6- INCH CHECK VALVE	2	EA	$	$
6		STRUCTURES				
	a	ROOF STRUCTURE FOUNDATION AND THICKENER BASE SLAB	1	LS	$	$
	b	ROOF STRUCTURE	1	LS	$	$

Bidder Name: _____

Authorized Signature: _____

BID FORM

(Submit in Triplicate)

SLUDGE HOLDING TANK IMPROVEMENTS AT THE SOUTHEAST WATER RECLAMATION FACILITY

Bid "B" Based on Completion Time of 365 Calendar Days

ITEM NO.		DESCRIPTION	EST. QTY.	U/M	UNIT PRICE	EXTENDED PRICE
7		ELECTRICAL, INSTRUMENTATION AND CONTROLS				
	a	ELECTRICAL	1	LS	$	$
	b	INSTRUMENTATION AND CONTROLS	1	LS	$	$
8	a	REMOVE DEBRIS FROM SLUDGE HOLDING TANKS	1,000	CY	$	$
		TOTAL BASE BID "B" - Based on Completion Time of 365 Calendar Days				$
9		CONTRACT CONTINGENCY WORK (USED ONLY WITH COUNTY APPROVAL)		10% OF TOTAL BASE BID		$
		TOTAL OFFER FOR BID "B" with Contract Contingency - Based on Completion Time of 365 Calendar Days				$

Bidder Name: _____

Authorized Signature: _____

MAILING LABEL

Cut along the outside border and affix this label to your sealed Bid envelope to identify it as a “Sealed Bid”. Be sure to include the name of the company submitting the Bid and the Bid due date and time where requested.

MAILING LABEL TO AFFIX TO OUTSIDE OF SEALED BID PACKAGE:

SEALED BID - DO NOT OPEN

CONTRACTOR: _____

SEALED BID NO: 14-0667CD

BID TITLE: Sludge Holding Tank Improvements at the Southeast Water Reclamation Facility

DUE DATE/TIME: _____ @ _____

FORM A

CONTRACTOR'S QUESTIONNAIRE

(Submit in Triplicate)

The Bidder warrants the truth and accuracy of all statements and answers herein contained. (Attach additional pages if necessary.)

THIS QUESTIONNAIRE MUST BE COMPLETED AND SUBMITTED WITH YOUR BID

1. Contact Information:

   License #: _____

   License Issued to: _____

   Date License Received (MM/DD/YR): _____

   Company Name: _____

   Physical Address: _____

   City: _____ State of Incorporation: _____ Zip Code: _____

   Phone Number: ( ) _____ Fax Number: ( ) _____

   Email address: _____

2. Bidding as: an individual __; a partnership __; a corporation __; a joint venture __

3. If a partnership, list names and addresses of partners; if a corporation, list names of officers, directors, shareholders, and state of incorporation; if joint venture, list names and address of ventures' and the same if any venture are a corporation for each such corporation, partnership, or joint venture:

   _____

   _____

   _____

   _____

4. Bidder is authorized to do business in the State of Florida: ☐ Yes ☐ No

   For how many years? _____

5. Your organization has been in business (under this firm's name) as a

   _____

   Is this firm in bankruptcy? _____

   BIDDER: _____

6. Attach a list of projects where this specific type of Work was performed.

7. Describe and give the date and County of the last three government or private work of similar scope you've completed which are similar in cost, type, size, and nature as this Project. Include contact name and phone number. Provide the budget, actual cost, size and summary of work for each project. Attach additional pages as necessary. (Note: If listing a Manatee County reference, contact person should not be directly associated with this Project.

_____

_____

_____

8. Have you ever been assessed liquidated damages under a Contract during the past five (5) years? If so, state when, where (contact name, address and phone number) and why.

_____

_____

_____

9. Have you ever failed to complete projects awarded to you? Or failed to complete projects within Contract Time? If so, state when, where (contact name, address, phone number) and why.

_____

_____

_____

10. Have you ever been debarred or prohibited from providing a Bid to a governmental entity? If yes, name the entity and describe the circumstances:

_____

_____

_____

BIDDER: _____

11. Will you subcontract any part of this Work? If so, describe which major portion(s):

_____

_____

_____

12. If any, list (with Contract amount) MBE/DBE to be utilized:

_____

_____

_____

13. What equipment do you own to accomplish this Work? (A listing may be attached)

_____

_____

_____

14. What equipment will you purchase/rent for the Work? (Specify which)

_____

_____

_____

15. List the following in connection with the Surety which is providing the bond(s):

Surety's Name: _____

Address: _____

_____

Name, address, phone number and email of Surety's resident agent for service of process in Florida:

Agent's Name: _____

Address: _____

_____

Phone: _____

Email: _____

BIDDER: _____

FORM B

PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES CERTIFICATION

SWORN STATEMENT PURSUANT TO ARTICLE V,
MANATEE COUNTY PURCHASING ORDINANCE

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 Manatee County Board of County Commissioners by

_____

[Print individual's name and title]

____ for _____[print name of entity submitting sworn statement]

whose business address is _____

and (if applicable) its 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 County Contract for public improvements, procurement of goods or services (including professional services) or a County lease, franchise, concession or management Contract, or shall receive a grant of County monies unless such person or entity has submitted a written certification to County that it has not:

(1) been convicted of bribery or attempting to bribe a public officer or employee of Manatee County, 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 County's Purchasing Official, 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 an 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 under this Article, or using substantially the same management, ownership or principles as the ineligible entity.

(Continued)

Any person or entity who claims that this Article is inapplicable to him/her/it because a conviction or judgment has been reversed by a court of competent jurisdiction shall prove the same with documentation satisfactory to County's Purchasing Official. Upon presentation of such satisfactory proof, the person or entity shall be allowed to contract with County.

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR MANATEE COUNTY 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 CONTRACTING OFFICER OR COUNTY ADMINISTRATOR DETERMINES THAT **SUCH PERSON OR ENTITY HAS MADE FALSE CERTIFICATION.**

_____
[Signature]

STATE OF FLORIDA
COUNTY OF _____

Sworn to and subscribed before me this ____ day of _____, 20_____ by _____

Personally known _____ OR Produced identification _____
[Type of identification]

_____ My commission expires _____
Notary Public Signature

_____
[Print, type or stamp Commissioned name of Notary Public]

Signatory Requirement - In the case of a business entity other than a partnership or a corporation, this affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, this affidavit shall be executed by the general partner(s). In the case of a corporation, this affidavit shall be executed by the corporate president.

FORM C

SWORN STATEMENT

THE FLORIDA TRENCH SAFETY ACT

THIS FORM MUST BE SIGNED IN THE PRESENCE OF A NOTARY PUBLIC OR BY AN OFFICER AUTHORIZED TO ADMINISTER OATHS.

1. This Sworn Statement is submitted with IFB No**. 14-0667CD**
2. This Sworn Statement is submitted by_____ whose business address is_____ and, if applicable, its Federal Employer Identification Number (FEIN) is_____. If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement _____.
3. Name of individual signing this Sworn Statement is: _____, Whose relationship to the above entity is: _____.
4. The Trench Safety Standards that will be in effect during the construction of this Project shall include, but are not limited to: Laws of Florida, Chapters 90-96, TRENCH SAFETY ACT, and OSHA RULES AND REGULATIONS 29 CFR 1926.650 Subpart P, effective October 1, 1990.
5. The undersigned assures that the entity will comply with the applicable Trench Safety Standards and agrees to indemnify and hold harmless County and Engineer, and any of their agents or employees from any claims arising from the failure to comply with said standard.
6. The undersigned has appropriated the following costs for compliance with the applicable standards:

Trench Safety Measure (Description)	Units of Measure (LF, SY)	Unit Quantity	Unit Cost	Extended Cost
a. _____	_____	_____	$_____	_____
b. _____	_____	_____	$_____	_____
c. _____	_____	_____	$_____	_____
d. _____	_____	_____	$_____	_____

7. The undersigned intends to comply with these standards by instituting the following procedures:
_____
_____
_____

THE UNDERSIGNED, in submitting this Bid, represents that they have reviewed and considered all available geotechnical information and made such other investigations and tests as they may deem necessary to adequately design the trench safety system(s) to be utilized on this Project.

_____
(AUTHORIZED SIGNATURE / TITLE)

SWORN to and subscribed before me this _____ day of _____, 20_____.
(Impress official seal)

Notary Public, State of Florida: _____

My commission expires: _____

R. B. "Chips" Shore

CLERK OF THE CIRCUIT COURT AND COMPTROLLER OF MANATEE COUNTY

1115 Manatee Avenue West, Bradenton, Florida 34205 - Phone (941) 749-1800 – Fax (941) 741-4082
P.O. Box 25400, Bradenton, Florida 34206 - www.manateeclerk.com

E PAYABLES APPLICATION

Company name_____

Contact person_____

Phone number_____

Email Address_____

FINANCE USE ONLY

Open orders: YES or NO
PEID _____
CREATE DATE _____
CONFIRMED WITH _____
Name and phone number

IFAS _____

BANK _____

INITIALS_____

Return completed form to:
Via email to:
lori.bryan@manateeclerk.com
Via fax to: (941) 741-4011
Via mail:
PO Box 1000
Bradenton, Fl 34206

Revised: June 26, 2013

CONTRACT DOCUMENTS

FOR

SOUTHEAST WATER RECLAMATION FACILITY
SLUDGE HANDLING IMPROVEMENTS

PROJECT # 6041981

October 2013

PROJECT OWNER:

County of Manatee, Florida
c/o Manatee County Purchasing Division
1112 Manatee Avenue West
Bradenton, Florida 34205
(941) 748-4501

PREPARED BY:

Stantec Consulting Services Inc.
5172 Station Way
Sarasota, Florida 34233
(941) 365-5500

CIVIL/MECHANICAL
Robert J. Halbach, P.E.
Florida P.E. #40139

STRUCTURAL
Heather R. Anesta, P.E.
Florida P.E. #74733

Gamboa Engineers, LLC
17433 SW 65th Court
Southwest Ranches, Florida 33331
(954) 533-1121

ELECTRICAL
Mario A. Gamboa, P.E.
Florida P.E. #44675

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INFRASTRUCTURE ENGINEERING STANDARD SPECIFICATIONS

This specification includes by reference the Manatee County Utility Standards approved May 2011.

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DIVISION 1 GENERAL REQUIREMENTS

SECTION 01005 GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE AND INTENT

A. Description

The work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all work included in this Contract.

B. Work Included

The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, shop drawings, working drawings and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits necessary for the work, other than those permits such as the DEP permit and railroad permit which may have already been obtained. He shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the County, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all incidental costs. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made.

The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment.

C. Public Utility Installations and Structures

Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto.

The Contractor shall protect all installations and structures from damage during the work. Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the County. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor which are shown on the Plans or have been located in the field by the utility shall be repaired by the Contractor, at his expense, as approved by the

County. No separate payment shall be made for such protection or repairs to public utility installations or structures.

Public utility installations or structures owned or controlled by the County or other governmental body, which are required by this contract to be removed, relocated, replaced or rebuilt by the Contractor not identified in any separate bid item shall be considered as a part of the general cost of doing the work and shall be included in the prices bid for the various contract items. No separate payment shall be made.

Where public utility installations or structures owned or controlled by the County or other governmental body are encountered during the course of the work, and are not indicated on the Plans or in the Specifications, and when, in the opinion of the County, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the County, for the contractor to accomplish. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is accomplished by the Contractor, it will be in accordance with the General and Supplemental General Conditions.

The Contractor shall give written notice to County and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of the work. This can be accomplished by making the appropriate contact with the "Sunshine State One-Call of Florida, Inc. Call Center ("Call Sunshine") and per all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the County.

1.02 PLANS AND SPECIFICATIONS

A. Plans

When obtaining data and information from the Plans, figures shall be used in preference to scaled dimensions, and large scale drawings in preference to small scale drawings.

B. Copies Furnished to Contractor

The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings

When, in the opinion of the County, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required,

drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the County and five paper prints thereof will be given to the Contractor.

D. Contractor to Check Plans and Data

The Contractor shall verify all dimensions, quantities and details shown on the Plans, Supplementary Drawings, Schedules, Specifications or other data received from the County, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting therefrom nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the County, should such errors or omissions be discovered. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. 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 for the work and shall always govern whenever there appears to be a conflict.

F. 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 in 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.

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 Related 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.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the County, that the manufacturer or subcontractor deal directly with the County. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery

The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories

The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

Spare parts shall be furnished as specified.

Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rating data.

D. Installation of Equipment.

The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character.

Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the County during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the County and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.

The Contractor shall furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations.

Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300M or provide a 1/32-inch neoprene gasket between the metal surface and the concrete or grout.

E. Service of Manufacturer's Engineer

The Contract prices for equipment shall include the cost of furnishing (as required by equipment specifications sections) a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation the equipment in conformity with the Contract Documents. After the equipment is placed in permanent operation by the County, such engineer or superintendent shall make all adjustments and tests required by the County to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the County in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

Inspection and testing of materials will be performed by the County unless otherwise specified.

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Three (3) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the County as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the County that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the County.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

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 County formally takes over the operation thereof.

B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the County or duly authorized inspection engineers or inspections bureaus without cost to the Contractor, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the County for compliance. The

Contractor shall reimburse the County for the expenditures incurred in making such tests on materials and equipment which are rejected for non-compliance.

C. Inspections of Materials

The Contractor shall give notice in writing to the County, at least two weeks in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture of preparation of materials. Upon receipt of such notice, the County will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture, or he will notify the Contractor that inspection will be waived. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture

When inspection is waived or when the County so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

E. Shop Tests of Operating Equipment

Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the work until the County notifies the Contractor, in writing, that the results of such tests are acceptable.

The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

F. Preliminary Field Tests

As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments and replacements required. The furnishing Contractor shall assist in the preliminary field tests as applicable.

G. Final Field Tests

Upon completion of the work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.

The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the County. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests

Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor. The decision of the County as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees of specified requirements, the County, notwithstanding its partial payment for work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

In case the County rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so, the County may, after the expiration of a period of thirty (30) calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment, and the cost thereof shall be deducted from any compensation due or which may become due the Contractor under his Contract.

I. Final Inspection

During such final inspections, the work shall be clean and free from water. In no case will the final pay application be prepared until the Contractor has complied with all requirements set forth and the County has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Document.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences

If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the County, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The County shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

1.06 TEMPORARY SERVICES

A. First Aid

The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the work.

1.07 LINES AND GRADES

A. Grade

All work under this Contract shall be constructed in accordance with the lines and grades shown on the Plans, or as given by the County. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

B. Safeguarding Marks

The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or removing without authorization such established points, stakes and marks.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

C. Datum Plane

All elevations indicated or specified refer to the Mean Sea Level Datum of the NGVD 1929 Datum and/or NAVD 1988.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility

The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Plans, and the removal, relocation and reconstruction of such items called for on the Plans or specified shall be included in the various Contract Items and no separate payments will be made therefore. Where such public and private property, structures of any kind and appurtenances thereto are not shown on the Plans and when, in the opinion of the County, additional work is deemed necessary to avoid interference with the work, payment therefore will be made as provided for in the General Conditions.

Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.

Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the

construction shall be made to the satisfaction of the County. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the County.

Prior to the beginning of any excavations, the Contractor shall advise the County of all buildings or structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.
2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.
3. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. If so ordered, the County will obtain any permits required for removal of trees. Such tree removal ordered shall be paid for under the appropriate Contract Items.

C. Lawn Areas

Lawn areas shall be left in as good condition as before the starting of the work. Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod.

D. Restoration of Fences

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the County. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific Item is provided therefore, as part of the overhead cost of the work, and no additional payment will be made therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights

During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public, in accordance with state and local requirements.

B. Smoke Prevention

A strict compliance with ordinances regulating the production and emission of smoke will be required. No open fires will be permitted.

C. Noise

The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all engines or other power equipment shall be provided with mufflers. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

D. Access to Public Services

Neither the materials excavated nor the materials or plant used in the construction of the work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.

E. Dust prevention

The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.10 CUTTING AND PATCHING

The Contractor shall do all cutting, fitting or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the County and in accordance with the Plans and Specifications. The work must be done by competent workmen skilled in the trade required by the restoration.

1.11 CLEANING

A. During Construction

During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the County, such material, debris, or rubbish constitutes a nuisance or is objectionable. The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.

B. Final Cleaning

At the conclusion of the work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

1.12 MISCELLANEOUS

A. Protection Against Siltation and Bank Erosion

1. The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches.
2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the County which results from his construction operations.

B. Protection of Wetland Areas

The Contractor shall properly dispose of all surplus material, including soil, in accordance with Local, State and Federal regulations. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Florida Department of Environmental Protection or Southwest Florida Water Management District.

C. Existing Facilities

The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Special Provisions.

D. Use of Chemicals

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01010 SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

A. The work included in this contract consists of furnishing and installing a gravity belt thickener and discharge pump, a sludge transfer pump, dual polymer feed system, complete with associated yard piping, electrical, instrumentation, and controls. An open-sided structure will be constructed over the gravity belt thickener. Diffusers in the two sludge holding tanks are to be replaced.

B. The Contractor shall furnish all shop drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the County.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

1.02 CONTRACTS

Construct all the Work under a single contract.

1.03 WORK SEQUENCE

A. All work done under this Contract shall be done with a minimum of inconvenience to the users of the system or facility. The Contractor shall coordinate his work with private property owners such that existing utility services are maintained to all users to the maximum extent possible.

B. The Contractor shall, if necessary and feasible, construct the work in stages to accommodate the County's use of the premises during the construction period; coordinate the construction schedule and operations with the County's Representative.

C. The Contractor shall, where feasible, construct the Work in stages to provide for public convenience and not close off public use of any facility until completion of construction to provide alternative usage.

1.04 CONSTRUCTION AREAS

A. The Contractor shall: Limit his use of the construction areas for work and for storage, to allow for:

1. Work by other Contractors.
2. County's Use.
3. Public Use.

B. Coordinate use of work site under direction of County's Representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored products under the Contractor's control, which interfere with operations of the County or separate contractor.

E. Obtain and pay for the use of additional storage of work areas needed for Contractor operations.

1.05 COUNTY OCCUPANCY

A. It is assumed that portions of the Work will be completed prior to completion of the entire Work. Upon completion of construction of each individual facility, including testing, if the County, at its sole discretion, desires to accept the individual facility, the Contractor will be issued a dated certificate of completion and acceptance for each individual facility. The County will assume ownership and begin operation of the individual facility on that date and the three-year guaranty period shall commence on that date. The County has the option of not accepting the entire work as a whole until it is completed, tested and approved by the County.

1.06 PARTIAL COUNTY OCCUPANCY

The Contractor shall schedule his operations for completion of portions of the Work, as designated, for the County's occupancy prior to substantial completion of the entire work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01015 CONTROL OF WORK

PART 1 GENERAL

1.01 WORK PROGRESS

The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Contract. If at any time such personnel appears to the County to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the County to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

The Contractor shall not enter or occupy private land outside of easements, except by permission of the affected property owner.

1.03 WORK LOCATIONS

Work shall be located substantially as indicated on the drawings, but the County reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.04 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 pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures such as limiting the length of 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 barricaded and well lighted at all times when construction is not in progress.

1.05 DISTRIBUTION SYSTEMS AND SERVICES

A. The Contractor shall avoid interruptions to water, telephone, cable TV, sewer, gas, or other related utility services. He shall notify the County and the appropriate agency well in advance of any requirement for dewatering, isolating, or relocating a section of a utility, so that necessary arrangements may be made.

B. If it appears that utility service will be interrupted for an extended period, the County may order the Contractor to provide temporary service lines at the Contractor's expense. Inconvenience of the users shall be kept to the minimum, consistent with existing conditions. The safety and integrity of the systems are of prime importance in scheduling work.

1.06 PROTECTION AND 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 building utilities, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables and other similar facilities, 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 operation shall be repaired by the Contractor at his expense.

B. The Contractor shall bear full responsibility for obtaining locations of all 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 unit prices established in the Bid.

D. If, in the opinion of the County, permanent relocation of a utility owned by the County is required, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work as classified in the General Conditions. If relocation of a privately owned utility is required, the County will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the County and utility and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least 48 hours (excluding Saturdays, Sundays and legal holidays) before excavating near their utilities.

1.07 TEST PITS

Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor immediately after the utility location and the surface shall be restored in a manner equal or better than the original condition. No separate payment will be made.

1.08 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 equal or better to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the County.

B. All sidewalks which are disturbed by the Contractor's operations shall be restored to their

original or better condition by the use of similar or comparable materials. All curbing shall be restored in a condition equal to the original construction and in accordance with the best modern practice.

C. 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 unless otherwise shown on the drawings. Fences and other features removed by the Contractor shall be replaced in the location indicated by the County as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and sodded to equal or exceed original conditions.

D. Trees close to the work which drawings do not specify to be removed, shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification to the County. All injuries to bark, trunk, limbs and roots of trees shall be repaired by dressing, cutting and painting according to approved methods, using only approved tools and materials.

E. 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 Bid.

1.09 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. Extended stoppage will be defined by the County.

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 safety measures which are satisfactory to the County.

C. Any changes to the traffic pattern require a Traffic Control Plan as detailed in section 01570 of this specification.

1.10 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may purchase water for all construction purposes.

B. The Contractor shall be responsible for paying for all water tap fees incurred for the purpose of obtaining a potable water service or temporary use meter.

1.11 MAINTENANCE OF FLOW

The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the work and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be

fully discussed with the County well in advance of the interruption of any flow.

1.12 CLEANUP

During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he 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.

1.13 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the County.

1.14 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 County. 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 County. 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 warranty period described in the Contract.

C. Further, 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 County.

1.15 CONSTRUCTION WITHIN RIGHT-OF-WAY

Where pipe lines are installed within FDOT right-of-way, all excavation backfill and compaction for the purpose of reconstructing roadways and/or adjacent slopes contiguous thereto shall be in accordance with FDOT or Manatee County Standards and Specifications, whichever is applicable. Contractor shall satisfy the authorized representative of the FDOT with respect to proper safety procedures, construction methods, required permitting, etc., within the FDOT right-of-way.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01030 SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the County to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the County. The costs for obtaining all permits shall be borne by the Contractor.

1.02 CONNECTIONS TO EXISTING SYSTEM

The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the existing systems all as shown on the Drawings or where directed by the County. The cost for this work and for the actual connection shall be included in the price bid for the project and shall not result in any additional cost to the County. The termination point for each contract shall be as shown on the Contract Drawings.

1.03 RELOCATIONS

The Contractor shall be responsible for the coordination of the relocation of structures, including but not limited to light poles, power poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the work as set out on the Drawings. No relocation of the items under this Contract shall be done without approval from the County.

1.04 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines.

B. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice.

C. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered. The Contractor shall be responsible for notifying the various utility companies to locate their respective utilities in advance of construction in conformance with all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

D. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the County and shall provide suggestions on how best to resolve the issue.

E. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County.

F. It is intended that wherever existing utilities such as water, sewer, gas, telephone, electrical, or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in the Drawings. However, when in the opinion of the County this procedure is not feasible, he may direct the use of fittings for a utilities crossing as detailed on the Drawings. No deflections will be allowed in gravity sanitary sewer lines or in existing storm sewer lines.

1.05 SUSPENSION OF WORK DUE TO WEATHER

Refer to FDOT Standards and Specifications Book, Section 8.

1.06 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the County a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the County in case of a hurricane warning.

B. In the event of inclement weather, or whenever County shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materials against damage or injury from the weather. If, in the opinion of the County, any portion of work or materials is damaged due to the failure on the part of the Contractor or Subcontractors to protect the work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.07 POWER SUPPLY

Electricity as may be required for construction and permanent power supply shall be secured and purchased by the Contractor.

1.08 SALVAGE

Any existing equipment or material, including, but not limited to, valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the County and if so shall be protected for a reasonable time until picked up by the County. Any equipment or material not worthy of salvaging, as directed by the County, shall be disposed of by the Contractor at no additional cost.

1.09 DEWATERING

A. The Contractor shall do all groundwater pumping necessary to prevent flotation of any part of the work during construction operations with his own equipment.

B. The Contractor shall pump out water and wastewater which may seep or leak into the excavations for the duration of the Contract and with his own equipment. He shall dispose of this water in an appropriate manner.

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing pipelines, structures or equipment, the Contractor shall notify the County, in writing, at least 10 calendar days in advance of the date he proposes to commence such work.

B. The Contractor shall provide, at his own expense, all necessary temporary facilities for access to and for protection of, all existing facilities. The County's personnel must have ready access at all times to the existing facilities. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the County.

1.11 CONSTRUCTION CONDITIONS

The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) and/or agency(ies) having jurisdiction over the work. Wherever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet Manatee County Ordinance #87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the County for excessive noise shall not relieve the Contractor of the other portions of this specification.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a period of three (3) years. Warranty period shall commence on the date of County acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the County.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications,

D. In the event that the manufacturer is unwilling to provide a three-year warranty commencing at the time of County acceptance, the Contractor shall obtain from the manufacturer a four (4) year warranty starting at the time of equipment delivery to the job site. This four-year warranty shall not relieve the Contractor of the three-year warranty starting at the time of County acceptance of the equipment.

1.14 FUEL STORAGE & FILLING

A. If the contractor is storing fuel on site, or doing his own fuel filling of portable equipment (other than hand-held equipment), he is responsible for any required response, clean-up or reporting required, at no additional cost to the county.

B. The Contractor shall prepare and submit a fuel storage / spill abatement plan prior to start of construction if required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01045 CUTTING AND PATCHING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.
2. Uncover portions of the work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Contract Documents.
5. Provide penetrations of non-structural surfaces for installation of piping and electrical conduit.

PART 2 PRODUCTS

2.01 MATERIALS

Comply with specifications and standards for each specific product involved.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to County. Do not proceed with work until County has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value to integrity of affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work and maintain excavations free from water.

3.03 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.

E. Replace surfaces airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

END OF SECTION

SECTION 01050 FIELD ENGINEERING AND SURVEYING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying service required for the project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the Work of the Contract.

1.02 QUALIFICATION OF SURVEYOR AND ENGINEER

All construction staking shall be conducted by or under the supervision of a Florida Registered Professional Surveyor and Mapper. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the County.

1.03 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the Project are designated on the Contract Drawings.

B. Locate and protect all survey monumentation, property corners and project control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of all survey monumentation, property corners and project control points shall be borne by the Contractor.

Make no changes or relocations without prior written notice to County.

Report to County when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

Require surveyor to replace project control points which may be lost or destroyed.

Establish replacements based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

The Contractor shall establish temporary bench marks as needed, referenced to data established by survey control points.

1.05 RECORDS

The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings per Section 01720.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01090 REFERENCE STANDARDS

PART 1 GENERAL

1.01 REQUIREMENTS

Abbreviations and acronyms used in Contract Documents to identify reference standards.

A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes established stricter standards.

B. Publication Date: The most recent publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.03 ABBREVIATIONS, NAMES AND ADDRESSES OR ORGANIZATIONS

Obtain copies of reference standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents.

AA Aluminum Association
818 Connecticut Avenue, N.W.
Washington, DC 20006

AASHTO American Association of State Highway and Transportation Officials
444 North Capital Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219

AI Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AISC American Institute of Steel Construction
1221 Avenue of the Americas
New York, NY 10020

AISI American Iron and Steel Institute
1000 16th Street NW
Washington, DC 20036

ANSI American National Standards Institute
1430 Broadway
New York, NY 10018

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
179l Tullie Circle, N.E.

Atlanta, GA 30329

ASME American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

AWS American Welding Society
2501 N.W. 7th Street
Miami, FL 33125

CRSI Concrete Reinforcing Steel Institute
180 North LaSalle Street, Suite 2110
Chicago, IL 60601

FDEP Florida Department of Environmental Protection
3900 Commonwealth Blvd.
Tallahassee, Florida 32399

FDOT Florida Department of Transportation Standards Specifications for Road and Bridge Construction
Maps & Publication Sales - Mail Station 12
605 Suwannee St.
Tallahassee, FL 32399-0450

FS Federal Specification
General Services Administration Specifications and Consumer Information Distribution Section (WFSIS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

MCPW UTIL STD Manatee County Utility Engineering
4410-B 66th St. W.
Bradenton, FL 34210

MLSFA Metal Lath/Steel Framing Association
221 North LaSalle Street
Chicago, IL 60601

MMA Monorail Manufacturer's Association
1326 Freeport Road
Pittsburgh, PA 15238

NAAMM National Association of Architectural Metal Manufacturers
221 North LaSalle Street

Chicago, IL 60601

NEMA National Electrical Manufacturer's Assoc.
2101 L Street N.W.
Washington, DC 20037

OHSA Occupational Safety and Health Assoc.
5807 Breckenridge Pkwy., Suite A
Tampa, FL 33610-4249

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 20076

PCI Prestressed Concrete Institute
20 North Wacker Drive
Chicago, IL 60606

SDI Steel Door Institute
712 Lakewood Center North
Cleveland, OH 44107

SMACNA Sheet Metal and Air Conditioning Contractor's National Association
8224 Old Court House Road
Vienna, VA 22180

SSPC Steel Structures Painting Council
402 24th Street, Suite 600
Pittsburgh, PA 15213

SWFWMD Southwest Florida Water Management District
2379 Broad Street
Brooksville, FL 34604-6899

UL Underwriter's Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01150 MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE

A. The scope of this section of the Contract Documents is to further define the items included in each Bid Item in the Bid Form section of the Contract Documents. Payment will be made based on the specified items included in the description in this section for each bid item.

B. All contract prices included in the Bid Form section will be full compensation for all shop drawings, working drawings, labor, materials, tools, equipment and incidentals necessary to complete the construction as shown on the Drawings and/or as specified in the Contract Documents to be performed under this Contract. Actual quantities of each item bid on a unit price basis will be determined upon completion of the construction in the manner set up for each item in this section of the Specifications. Payment for all items listed in the Bid Form will constitute full compensation for all work shown and/or specified to be performed under this Contract.

1.02 ESTIMATED QUANTITIES

The quantities shown are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. The County does not assume any responsibility for the final quantities, nor shall the Contractor claim misunderstanding because of such estimate of quantities. Final payment will be made only for satisfactorily completed quantity of each item.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

No payment will be made for work constructed outside the authorized limits of work.

1.04 MEASUREMENT STANDARDS

Unless otherwise specified for the particular items involved, all measurements of distance shall be taken horizontally or vertically.

1.05 AREA MEASUREMENTS

In the measurement of items to be paid for on the basis of area of finished work, the lengths and/or widths to be used in the calculations shall be the final dimensions measured along the surface of the completed work within the neat lines shown or designated.

1.06 LUMP SUM ITEMS

Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum items. Lump sum contracts shall be complete, tested and fully operable prior to request for final payment. Contractor may be required to provide a break-down of the lump sum totals.

1.07 UNIT PRICE ITEM

A. Separate payment will be made for the items of work described herein and listed on the Bid Form. Any related work not specifically listed, but required for satisfactory completion of the work shall be considered to be included in the scope of the appropriate listed work items.

B. No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work. Final payments shall not be requested by the Contractor or made by the County until as-built (record) drawings have been submitted and approved by the County.

1. Shop Drawings, Working Drawings.
2. Clearing, grubbing and grading except as hereinafter specified.
3. Trench excavation, including necessary pavement removal and rock removal, except as otherwise specified.
4. Dewatering and disposal of surplus water.
5. Structural fill, backfill, and grading.
6. Replacement of unpaved roadways, and shrubbery plots.
7. Cleanup and miscellaneous work.
8. Foundation and borrow materials, except as hereinafter specified.
9. Testing and placing system in operation.
10. Any material and equipment required to be installed and utilized for the tests.
11. Pipe, structures, pavement replacement, asphalt and shell driveways and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
12. Maintaining the existing quality of service during construction.
13. Maintaining or detouring of traffic.
14. Appurtenant work as required for a complete and operable system.
15. Seeding and hydro mulching.
16. As-built Record Drawings.

1.08 BID ITEMS

A. Mobilization (Bid Item 1)

1. Measurement and payment for this Bid Item shall include full compensation for the required 100 percent (100%) Performance Bond, 100 Percent (100%) Payment Bond, all required insurance for the project and the Contractor's mobilization and demobilization costs as shown in the Bid Form. Mobilization includes, but is not limited to: preparation and movement of personnel, equipment, supplies and incidentals such as safety and sanitary supplies/ facilities
2. Payment for mobilization shall not exceed 10 percent (10%) of the total Contract cost unless the Contractor can prove to the County that his actual mobilization cost exceeds 10 percent (10%).
3. Partial payments for this Bid Item will be made in accordance with the following schedule:

Percent of Original Contract Amount:	Percent Allowable Payment of Mobilization/Demobilization Bid Item Price:
5	25
10	35

25	45
50	50
75	75
100	100

4. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

B. Gravity Belt Thickener (Bid Item 2a)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing one gravity belt thickener, including mounting the thickener, polymer injection block and mixer, washwater pump, hydraulic pump and motor, discharge chute, catwalk, stairs, handrails, and kickplates. This item includes all above ground piping from the polymer manifold block and injection ring to the flange on the discharge chute, as well as washwater piping from the washwwater pump to the thickener, and hydraulic hoses and connections. This item includes all adjustment, startup, testing, and commissioning.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

C. Thickened Sludge Pump (Pump No. 8) (Bid Item 2b)

1. Payment for all work included in these Bid Items will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing one thickened sludge pump at the discharge of the gravity belt thickener, including the pump, motor, sheaves, seals, seal water piping with solenoid valve, isolation valves, gauges, concrete housekeeping pad, and painting of the exterior surfaces. This item includes all adjustment, startup, testing, and commissioning.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

D. Dual Polymer Feed (Bid Item 2c)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing two polymer feed units, including the polymer feed skids, water supply piping, polymer suction piping, and piping to the polymer manifold block and removal and disposal of the existing unit. This item includes all adjustment, startup, testing, and commissioning.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

E. Sludge Transfer Pump No. 5 (Bid Item 2d)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing one sludge transfer pump between two existing pumps, including the pump, motor, sheaves, seals, seal water piping with solenoid valve, isolation valves, gauges, concrete housekeeping pad, and painting of the exterior surfaces. This item includes all adjustment, startup, testing, and commissioning.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

F. Diffusers (Bid Item 3)

1. Payment for all work included in this Bid Item will be made at the applicable Contract unit price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing diffusers in each of the two sludge holding tanks, including removal and disposal of the existing diffusers, and modifications to the existing manifold pipes.
2. Payment will be based on the units complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

G. Yard Piping (Bid Item 4)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing pipe and fittings of the size and material indicated on the Drawings. This item includes all necessary fittings, labor, equipment and materials for the furnishing, laying, and hanging of the pipe, construction stakeout, installing and maintaining silt fence, erosion control, clearing and grubbing, fittings, joint restraint, maintenance of traffic, dewatering, compaction, pipe bedding, backfilling, sheeting, mylar detectable tape, tracer wire, polyethylene sleeve, clamps, harnessing, supports, hangers, plugs and caps, adapters, excavation of all material encountered including rock, bedding, backfill, site grading, seeding and mulching, replacement of grass, sod, pavement, driveways, sidewalks, and other surface materials not specifically designated in the Bid, clean-up, line flushing, pressure testing, connections to existing pipes, and painting of the exterior surfaces.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

H. Valves (Bid Items 5a through 5d)

1. Payment for all work included in this Bid Item will be made at the applicable Contract unit price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing valves of the size, type, and location indicated on the Drawings. This item includes the valve, box and all necessary labor, materials and equipment for installation, including valve stem, valve box extensions, joints, operators, handwheels, levers, concrete pads as necessary for the location of the valve, and painting of the exterior surfaces. For buried valves, this item also includes the installation of base material below the valve in accordance with the detail shown on the Drawings.
2. Payment will be based on the units complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

I. Roof Structure Foundation and Thickener Base Slab (Bid Item 6a)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing the roof structure foundation and thickener base slab, including all foundations, containment curbs, and pedestals. This item includes all labor, materials, and equipment for all formwork, reinforcing, vapor barrier, embedments, concrete placement, finishing, curing, and grouting.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

J. Roof Structure (Bid Item 6b)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing the roof structure over the thickener. This item shall include all labor, materials, and equipment to construct the structure, including all columns, beams, joists, purlins, braces, roofing, anchors, and hardware.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

K. Electrical (Bid Item 7a)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing all electrical equipment, including panels, circuit breakers, starters, variable frequency drives, conduit, wiring, switches, local disconnects, connections to electrically operated equipment, grounding and lighting. This also includes removal and replacement of the existing thickener's roof structures lighting and the addition of grounding.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

L. Instrumentation and Controls (Bid Item 7b)

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price bid listed in the Bid Form, and shall represent full compensation for furnishing and installing instruments and controls necessary to operate the mechanical equipment installed under this Contract via the Supervisory Control and Data Acquisition (SCADA) system. This item includes PLCs, instruments, gauges, transmitters, conduit, wiring, programming, and graphics. This item also includes coordinating with the County's SCADA consultant.
2. Payment will be based on the percent complete at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

M. Remove Debris from Sludge Holding Tanks (Bid Item 8a)

1. Payment for all work included in this Bid Item will be made at the applicable Contract unit price bid listed in the Bid Form, and shall represent full compensation for draining the two sludge holding tanks and removing and hauling of debris. This item includes coordination with treatment plant operators, draining tanks, collecting and dewatering debris, hauling, and disposal of debris.
2. Measurement for payment shall be the volume of debris removed, and payment shall be based on the volume removed at the time of preparation of the monthly application for payment. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the work and demobilization.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01152 REQUESTS FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Submit Applications for Payment to the Project Manager or as directed at the preconstruction meeting, in accordance with the schedule established by Conditions of the Contract and Agreement between County and Contractor.

1.02 FORMAT AND DATA REQUIRED

A. Submit payment requests in the form provided by the County with itemized data typed in accordance with the Bid Form.

B. Provide construction photographs in accordance with Contract Documents.

1.03 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the County requires substantiating data, Contractor shall submit suitable information with a cover letter.

B. Submit one copy of data and cover letter for each copy of application.

1.04 PREPARATION OF APPLICATION FOR FINAL PAYMENT

Fill in application form as specified for progress payments.

1.05 SUBMITTAL PROCEDURE

A. Submit applications for payment at the times stipulated in the Agreement.

B. Number: Three (3) copies of each application; all signed and certified by the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01153 CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 DEFINITION

A. Change Order: Change in contract scope, price or time that must be approved and executed by the Project Representative before it becomes effective.

B. Administrative Contract Adjustment: Minor change order under 10% of project cost or 20% time, does not have to be Board approved.

C. Field Directive: Change to contract quantity that does not require a change of price or time extension.

1.02 REQUIREMENTS INCLUDED

A. The Contractor shall promptly implement change order procedures:

1. Provide full written data required to evaluate changes.
2. Maintain detailed records of work done on a time-and-material/force account basis.
3. Provide full documentation to County on request.

B. The Contractor shall designate a member of the Contractor's organization who:

1. Is authorized to accept changes to the Work.
2. Is responsible for informing others in the Contractor's employ of the authorized changes into the Work.

1.03 PRELIMINARY PROCEDURES

A. Project Manager may initiate changes by submitting a Request to Contractor. Request will include:

1. Detailed description of the change, products, costs and location of the change in the Project.
2. Supplementary or revised Drawings and Specifications.
3. The projected time extension for making the change.
4. A specified period of time during which the requested price will be considered valid.
5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to the Project Manager, containing:

1. Description of the proposed changes.
2. Statement of the reason for making the changes.
3. Statement of the effect on the Contract Sum and the Contract Time.
4. Statement of the effect on the work of separate contractors.

5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.04 FIELD DIRECTIVE CHANGE

A. In lieu of a Change Order, the Project Manager may issue a Field Directive for the Contractor to proceed with additional work within the original intent of the Project.

B. Field Directive will describe changes in the work, with attachments of backup information to define details of the change.

C. Contractor must sign and date the Field Directive to indicate agreement with the terms therein.

1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow the County to evaluate the quotation.

B. On request, provide additional data to support time and cost computations:

1. Labor required.
2. Equipment required.
3. Products required.
    a. Recommended source of purchase and unit cost.
    b. Quantities required.
4. Taxes, insurance and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.
7. Justification for any change in Contract Time.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal.

1. Name of the County's authorized agent who ordered the work and date of the order.
2. Date and time work was performed and by whom.
3. Time record, summary of hours work and hourly rates paid.
4. Receipts and invoices for:
    a. Equipment used, listing dates and time of use.
    b. Products used, listing of quantities.
    c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS

A. Project Manager will prepare each Change Order.

B. Change Order will describe changes in the Work, both additions and deletions, with attachments as necessary to define details of the change.

C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the

Contract Time.

1.07 LUMP SUM/FIXED PRICE CHANGE ORDER

A. Project Manager initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by the Contractor, or requests from the County, or both.

B. Once the form has been completed, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to County for approval. The County will distribute executed copies after approval by the Board of County Commissioners.

1.08 UNIT PRICE CHANGE ORDER

A. Contents of Change Orders will be based on, either:

1. County's definition of the scope of the required changes.
2. Contractor's Proposal for a change, as approved by the County.
3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.
2. Those mutually agreed upon between County and Contractor.

1.09 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION CHANGE AUTHORIZATION

A. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.

B. County will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

C. County will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

D. County and Contractor will sign and date the Change Order to indicate their agreement therewith.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Application for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time. Revise sub schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200 PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The County shall schedule the pre-construction meeting, periodic progress meetings and special meetings, if required, throughout progress of work.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Attendance:

1. County's Engineer.
2. County's Project Manager
3. Contractor.
4. Resident Project Representative.
5. Related Labor Contractor's Superintendent.
6. Major Subcontractors.
7. Major Suppliers.
8. Others as appropriate.

B. Suggested Agenda:

1. Distribution and discussion of:
    a. List of major subcontractors.
    b. Projected Construction Schedules.
    c. Coordination of Utilities
2. Critical work sequencing.
3. Project Coordination.
    a. Designation of responsible personnel.
    b. Emergency contact persons with phone numbers.
4. Procedures and processing of:
    a. Field decisions.
    b. Submittals.
    c. Change Orders.
    d. Applications for Payment.
5. Procedures for maintaining Record Documents.
6. Use of premises:
    a. Office, work and storage areas.
    b. County's REQUIREMENTS.
7. Temporary utilities.
8. Housekeeping procedures.
9. Liquidated damages.
10. Equal Opportunity Requirements.

11. Laboratory testing.
12. Project / Job meetings: Progress meeting, other special topics as needed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310 CONSTRUCTION SCHEDULE & PROJECT RESTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated with the County and accomplished in a logical order to maintain utilization and flow through existing facilities and public properties and rights-of-way and to allow construction to be completed within the time allowed by Contract Documents and in the manner set forth in the Contract.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 7:00 p.m. and 7:00 a.m. nor on weekends or legal holidays without written permission of the County. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as regular procedure with the written permission of the County. Such permission, however, may be revoked at any time by the County if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. Due to potential health hazards and requirements of the State of Florida and the U.S. Environmental Protection Agency, existing facilities must be maintained in operation.

D. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, lighting, temporary structure, or other materials, equipment and systems required to maintain the existing facility's operations. All details of temporary piping and temporary construction are not necessarily shown on the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt proper facility operations.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor's schedule.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule as described herein.

B. The planning, scheduling, management and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow County to review Contractor's planning, scheduling, management and execution of the work; to assist County in evaluating work progress and make progress payments and to allow other contractors to cooperate and coordinate their activities with those of the Contractor.

2.02 FORM OF SCHEDULES

A. Prepare schedules using the latest version of Microsoft Project, or other County approved software, in the form of a horizontal bar chart diagram. The diagram shall be time-scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Values. Activity durations shall be in whole working days. In addition, man-days shall be shown for each activity or tabulated in an accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 8-1/2 inches by 11 inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

2.03 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description for each activity shall be brief, but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; contractor's time required for submittals, fabrication and deliveries; the time required by County to review all submittals as set forth in the Contract Documents; items of work required of County to support pre-operational, startup and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contractors performing work under separate contracts with County.

D. Schedules shall show the complete sequence of construction by activities. Dates for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittal schedule for shop drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the County, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change orders.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay and shall further include the following: separate activity identification, activity description indicating cause of the delay, activity duration consistent with whichever set of dates below applies, the actual start and finish dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternatives

available to mitigate the delay including acceleration alternatives and further show the following: separate activity identification, activity description indicating cause of the potential delay and activity duration equal to zero work days.

2.04 SUPPORTING NARRATIVE

A. Status and scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the Contract conditions and restraints incorporated into the schedule and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the monthly report period and actual start
   dates for activities commenced during the monthly report period.
2. Anticipated start dates for activities scheduled to commence during the following monthly report period.
3. Changes in the duration of any activity and minor logic changes.
4. The progress along the critical path in terms of days ahead or behind the Contract date.
5. If the Monthly Status Report indicates an avoidable delay to the Contract completion date or interim completion dates as specified in the Agreement, Contractor shall identify the problem, cause and the activities affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.
6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and restraints of each activity.
7. The narrative shall also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced change order work activities and the CPM path(s) that they affect, must be specifically identified. All change order work activities added to the schedule shall conform with the sequencing and Contract Time requirements of the applicable Change Order.
8. Original Contract date(s) shall not be changed except by Contract change order. A revision need not be submitted when the foregoing situations arise unless required by County. Review of a report containing added activities will not be construed to be concurrence with the duration or restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract change order shall govern.
9. Should County require additional data, this information shall be supplied by Contractor within 10 calendar days.

2.05 SUBMITTALS

A. Contractor shall submit estimated and preliminary progress schedules (as identified in the Terms and Conditions of the Contract and the General Conditions), monthly status reports, a start-up schedule and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with the Contract Documents.

C. The finalized progress schedule discussed in the Contract Documents shall be the first

monthly status report and as such shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include a time-scaled (days after notice to proceed) diagram showing all contract activities and supporting narrative. The initial detailed schedule shall use the notice to proceed as the start date. The finalized schedule, if concurred with by County, shall be the work plan to be used by the contractor for planning, scheduling, managing and executing the work.

E. The schedule diagram shall be formatted as above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittals, (2) calendar days prior to substantial completion, (3) summary activities for the remaining days. The critical path activities shall be identified, including critical paths for interim dates, if possible.

F. The Contractor shall submit progress schedules with each application for payment.

2.06 MONTHLY STATUS REPORTS

A. Contractor shall submit detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include a "marked-up" copy of the latest detailed schedule of legal status and a supporting narrative including updated information as described above. The Monthly Report will be reviewed by County and Contractor at a monthly schedule meeting and Contractor will address County's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "marked-up" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal status shall be added, except that contractual dates will not be changed except by change order. Review of a marked-up diagram by County will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate change order shall govern.

2.07 STARTUP SCHEDULE

A. At least 60 calendar days prior to the date of substantial completion, Contractor shall submit a time-scaled (days after notice to proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion, together with a supporting narrative. County shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of County's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by County, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last 60 calendar days prior to substantial completion and detailed activities for the remaining 60-day period within the time frames outlined in the latest

schedule of legal status.

C. Contractor will be required to continue the requirement for monthly reports, as outlined above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the startup schedule.

2.08 REVISIONS

A. All revised Schedule Submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review and concurrence by County. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review when required by County.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01340 SHOP DRAWINGS, PROJECT DATA AND SAMPLES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the County for review and approval: 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 is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the County. This log should include the following items:

1. Submittal description and number assigned.
2. Date to County.
3. Date returned to Contractor (from County).
4. Status of Submittal (No exceptions taken, returned for confirmation or resubmittal, 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. Projected date and required lead time so that product installation does not delay contact.
10. Status of O&M manuals submitted.

1.03 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the County for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the County without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the contract Documents.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications and indicate all variances from the Specifications.

C. The Contractor shall furnish the County a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the County, with No Exceptions Taken or Approved As Noted.

E. The Contractor shall submit to the County all drawings and schedules sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for checking and appropriate action from the time the County receives them.

F. All material & product submittals, other than samples, may be transmitted electronically as a pdf file. All returns to the contractor will be as a pdf file only unless specifically requested otherwise.

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 completion of the review by County of the necessary Shop Drawings.

1.04 COUNTY'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS

A. The County's review of drawings, data and samples submitted by the Contractor shall cover only general conformity to the Specifications, external connections and dimensions which affect the installation.

B. The review of drawings and schedules shall be general and 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 County, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the County finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or time for performance, the County may return the reviewed drawings without noting any exception.

D. When reviewed by the County, each of the Shop and Working Drawings shall be identified as having received such review being so stamped and dated. Shop Drawings stamped "REJECTED" and with required corrections shown shall be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the County on previous submissions. The Contractor shall make any corrections required by the County.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the County.

G. The County shall review a submittal/resubmittal a maximum of three (3) times after which cost of review shall be borne by the Contractor. The cost of engineering shall be equal to the County's actual payroll cost.

H. When the Shop and Working Drawings have been completed to the satisfaction of the County, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the County.

I. No partial submittals shall be reviewed. Incomplete submittals shall be returned to the Contractor and shall be considered not approved until resubmitted.

1.05 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, drawings, setting drawings, schedule drawings, manufacturer's scale drawings and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the County and shall bear the Contractor's stamp of approval and original signature as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval and original signature shall be returned to the Contractor for resubmission.

C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Number and title of the drawing.
2. Date of Drawing or revision.
3. Name of project building or facility.
4. Name of contractor and subcontractor submitting drawing.
5. Clear identification of contents and location of the work.
6. Specification title and number.

D. If drawings 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. 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 of executing the work in accordance with the Contract, even though such drawings have been reviewed.

E. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

F. 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.

G. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the County along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and have been in operation for a period of at least one (1) year.

H. Only the County will utilize the color "red" in marking shop drawing submittals.

1.06 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's fabrication and erection drawings for structures such as roof trusses, steelwork, precast concrete elements, bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and false work; underpinning; and for such other work as may be required for construction of the project.

B. Copies of working drawings as noted above, shall be submitted to the County where required by the Contract Documents or requested by the County and shall be submitted at least thirty (30) days (unless otherwise specified by the County) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation 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 County, which 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 County and Engineer shall not have responsibility therefor.

1.07 SAMPLES

A. The Contractor shall furnish, for the review of the County, samples required by the Contract Documents or requested by the County. Samples shall be delivered to the County as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the County.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.
3. A minimum of two samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of product.
2. Name of Contractor and Subcontractor.

3. Material or equipment represented.
4. Place of origin.
5. Name of Producer and Brand (if any).
6. Location in project.
   (Samples of finished materials shall have additional markings that will identify them under the finished schedules.)
7. Reference specification paragraph.

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the County. Review of a sample shall be only for the characteristics or use named in such and shall not be construed to change or modify any Contract requirements.

E. Reviewed samples not destroyed in testing shall be sent to the County or stored at the site of the work. Reviewed samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the reviewed samples. If requested at the time of submission, samples which failed testing or were rejected shall be returned to the Contractor at his expense.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01370 SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the County a Schedule of Values allocated to the various portions of the work, within 10 days after date of Notice to Proceed.

B. Upon request of the County, the Contractor shall support the values with data which will substantiate their correctness.

C. The Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Schedule of Values will be considered for approval by County upon Contractor's request. Identify schedule with:

1. Title of Project and location.
2. Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule of Values shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents for the Contract Document as the format for listing component items for structures:

1. Identify each line item with the number and title of the respective major section of the specification.
2. For each line item, list sub values of major products or operations under item.

D. Follow the bid sheets included in this Contract Documents as the format for listing component items for pipe lines.

E. The sum of all values listed in the schedule shall equal the total Contract sum.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01380 CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall employ a competent photographer to take construction record photographs or perform video, recording including furnishing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video recordings of all construction areas.

B. Preconstruction record information shall consist of video recordings on digital video disks (DVD).

C. Construction progress information shall consist of photographs and digital photographs on a recordable compact disc (CD-R).

1.02 QUALIFICATIONS

A. All photography shall be done by a competent 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.

1.03 PROJECT PHOTOGRAPHS

A. Provide one print of each photograph with each pay application.

B. Provide one recordable compact disc with digital photographs with each pay application.

C. Negatives:

1. All negatives shall remain the property of photographer.
2. The Contractor shall require that photographer maintain negatives or protected digital files for a period of two years from date of substantial completion of the project.
3. Photographer shall agree to furnish additional prints to County at commercial rates applicable at time of purchase. Photographer shall also agree to participate as required in any litigation requiring the photographer as an expert witness.

D. The Contractor shall pay all costs associated with the required photography and prints. Any parties requiring additional photography or prints shall pay the photographer directly.

E. All project photographs shall be a single weight, color image. All finishes shall be smooth surface and glossy and all prints shall be 8 inches x 10 inches.

F. Each print shall have clearly marked on the back, the name of the project, the orientation of view, the date and time of exposure, name and address of the photographer and the photographers numbered identification of exposure.

G. All project photographs shall be taken from locations to adequately illustrate conditions prior to construction, or conditions of construction and state of progress. The Contractor shall consult with the County at each period of photography for instructions concerning views required.

1.04 VIDEO RECORDINGS

A. Video, recording shall be done along all routes that are scheduled for construction. Video, recording shall include full, recording of both sides of all streets and the entire width of easements plus 10 feet on each side on which construction is to be performed. All video recording shall be in full color.

B. A complete view, in sufficient detail with audio description of the exact location shall be provided.

C. The engineering plans shall be used as a reference for stationing in the audio portion of the recordings for easy location identification.

D. Two complete sets of video recordings shall be delivered to the County on digital video disks (DVD) for the permanent and exclusive use of the County prior to the start of any construction on the project.

E. All video recordings shall contain the name of the project, the date and time of the video, recording, the name and address of the photographer and any other identifying information required.

F. Construction shall not start until preconstruction video recordings are completed, submitted and accepted by the County. In addition, no progress payments shall be made until the preconstruction video recordings are accepted by the County.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01410 TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. County shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or called out in the Specifications. County may elect to have materials and equipment tested for conformity with the Contract Documents at any time.

1. Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.
2. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the work of the Contract.

1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The County may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor and no extra charge to the County shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the project site or at the source of the product to be tested.

3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to insufficient notice, Contractor shall reimburse County for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the County.

H. If the test results indicate the material or equipment complies with the Contract Documents, the County shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01510 TEMPORARY AND PERMANENT UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

The Contractor shall be responsible for furnishing all requisite temporary utilities, i.e., power, water, sanitation, etc. The Contractor shall obtain and pay for all permits required as well as pay for all temporary usages. The Contractor shall remove all temporary facilities upon completion of work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with Federal, State and Local codes and regulations and with utility company requirements.

C. Comply with County Health Department regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

Materials for temporary utilities may be "used". Materials for electrical utilities shall be adequate in capacity for the required usage, shall not create unsafe conditions and shall not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

Arrange with the applicable utility company for temporary power supply. Provide service required for temporary power and lighting and pay all costs for permits, service and for power used.

2.03 TEMPORARY WATER

A. The Contractor shall arrange with Manatee County Utilities Customer Service office to provide water for construction purposes, i.e., meter, pay all costs for installation, maintenance and removal, and service charges for water used.

B. The Contractor shall protect piping and fitting against freezing.

2.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide sanitary facilities in compliance with all laws and regulations.

B. The Contractor shall service, clean and maintain facilities and enclosures.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall maintain and operate systems to assure continuous service.

B. The Contractor shall modify and extend systems as work progress requires.

3.02 REMOVAL

A. The Contractor shall completely remove temporary materials and equipment when their use is no longer required.

B. The Contractor shall clean and repair damage caused by temporary installations or use of temporary facilities.

END OF SECTION

SECTION 01570 TRAFFIC REGULATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the Contractor and which interfere with the driving or walking public.

B. The Contractor shall remove temporary equipment and facilities when no longer required, restore grounds to original or to specified conditions.

1.02 TRAFFIC CONTROL

A. The necessary traffic control shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, markings, barricades, channelization and hand signaling devices. The Contractor shall be responsible for installation and maintenance of all devices and detour routes and signage for the duration of the construction period. The Contractor shall utilize the appropriate traffic plan from the FDOT Maintenance of Traffic Standards, Series 600 of the FDOT Roadway & Traffic Design Standards, Latest Edition.

B. Should there be the necessity to close any portion of a roadway carrying vehicles or pedestrians the Contractor shall submit a Traffic Control Plan (TCP) at least 5 days before a partial or full day closure, and at least 8 days before a multi-day closure. TCP shall be submitted, along with a copy of their accreditation, by a certified IMSA or ATSA Traffic Control Specialist.

1. At no time will more than one (1) lane of a roadway be closed to vehicles and pedestrians without an approved road closure from the County Transportation Department. With any such closings, adequate provision shall be made for the safe expeditious movement of each.
2. All traffic control signs must be in place and inspected at least 1 day in advance of the closure. Multi-day closures notification signs shall be in place at least 3 days in advance of the closure. All signs must be covered when no in effect, and checked twice a day by the Worksite Traffic Supervisor when they are in effect.

C. The Contractor shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal preconstruction traffic control scheme. Any such actions shall be performed by the Contractor under the supervision and in accordance with the instructions of the applicable highway department unless otherwise specified.

D. The Contractor will consult with the County immediately on any vehicular or pedestrian safety or efficiency problem incurred as a result of construction of the project.

E. The Contractor shall provide ready access to businesses and homes in the project area during construction. The Contractor shall be responsible for coordinating this work with affected homeowners.

F. When conditions require the temporary installation of signs, pavement markings and traffic barriers for the protection or workers and traffic, the entire array of such devices shall be depicted on working drawings for each separate stage of work. These drawings shall be submitted to the County for review and approval prior to commencement of work on the site.

G. Precast concrete traffic barriers shall be placed adjacent to trenches and other excavations deeper than six inches below the adjacent pavement surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01580 PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish, install and maintain County project identification signs.

B. Remove signs on completion of construction.

C. Allow no other signs to be displayed except for traffic control and safety.

1.02 PROJECT IDENTIFICATION SIGN (COUNTY)

A. One painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:

1. Title of Project.
2. Name of County.
3. Names and titles of authorities as directed by County.
4. Prime Contractor.

B. Graphic design, style of lettering and colors: As approved by the County.

C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the County

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.
2. Colors: as required by regulatory agencies, otherwise of uniform colors throughout project.

B. Erect at appropriate locations to provide required information.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

1.05 PUBLIC NOTIFICATION

A. Door Hangers: The Contractor shall generate and distribute door hangers to all residents who will be impacted by project construction.

1. Residents impacted include anyone who resides inside, or within 500 feet of project limits of construction.

B. Door Hangers shall be distributed prior to start of construction of the project. Hangers shall be affixed to doors of residents via elastic bands or tape.

EXAMPLE:

PLEASE PARDON THE INCONVENIENCE WHILE THE ROADWAY IS BEING RECONSTRUCTED IN YOUR NEIGHBORHOOD

This project consists of utility improvements and the reconstruction of ??? Boulevard from U.S. ??? to ??? Street West. The project is expected to begin in August, 200X and be completed in July 200X.

Location Map

WE HOPE TO KEEP ANY INCONVENIENCE TO A MINIMUM. HOWEVER, IF YOU HAVE ANY PROBLEMS, PLEASE CONTACT THE FOLLOWING:

A. Contractor
Contractor Address
Contractor Phone (Site Phone)

Project Manager
PM Address
PM Phone No. & Ext.

B. Project Inspector
Inspector Phone Number

AFTER HOURS EMERGENCY NUMBER – (941) 747-HELP
THANK YOU FOR YOUR UNDERSTANDING AND PATIENCE
MANATEE COUNTY GOVERNMENT – PROJECT MANAGEMENT DEPT.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified in the Contract Documents.

PART 3 EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Paint exposed surface or supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, size and colors selected.

3.02 MAINTENANCE

The Contractor shall maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

3.03 REMOVAL

The Contractor shall remove signs, framing, supports and foundations at completion of project.

END OF SECTION

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SECTION 01600 MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type and quality specified, or as specifically approved in writing by the County.
3. Manufactured and Fabricated Products:
    a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
    b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
    c. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.
    d. Products shall be suitable for service conditions.
    e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
4. Do not use material or equipment for any purpose other than that for which it is specified.
5. All material and equipment incorporated into the project shall be new.

1.02 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to County. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with County prior to proceeding. Do not proceed with work without clear instructions.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 SUBSTITUTIONS AND PRODUCT OPTIONS

Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.
2. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions of any product or manufacturer not specifically named in a timely manner so as not to adversely affect the construction schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01620 STORAGE AND PROTECTION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Provide secure storage and protection for products to be incorporated into the work and maintenance and protection for products after installation and until completion of Work.

1.02 STORAGE

A. Store products immediately on delivery and protect until installed in the Work, in accord with manufacturer's instructions, with seals and labels intact and legible.

B. Exterior Storage

1. Provide substantial platform, blocking or skids to support fabricated products above ground to prevent soiling or staining.
   a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
   b. Prevent mixing of refuse or chemically injurious materials or liquids.

A. Arrange storage in manner to provide easy access for inspection.

1.03 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.
2. Required environmental conditions are maintained on continuing basis.
3. Surfaces of products exposed to elements are not adversely affected. Any weathering of products, coatings and finishes is not acceptable under requirements of these Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Equipment shall not be shipped until approved by the County. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the County.
2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the County until such time as the equipment is to be installed.
3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
4. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the

equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

5. Lubricants shall be changed upon completion of installation and as frequently as required, thereafter during the period between installation and acceptance.
6. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.04 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700 CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.02 SUBSTANTIAL COMPLETION

A. The Contractor shall submit the following items when the Contractor considers the work to be substantially complete:

1. A written notice that the work, or designated portion thereof, is substantially complete.
2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the County shall make an inspection to determine the status of completion.

C. Project record documents and operations and maintenance manuals must be submitted before the project shall be considered substantially complete.

D. If the County determines that the work is not substantially complete:

1. The County shall notify the Contractor in writing, stating the reasons.
2. The Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the County.
3. The County shall reinspect the work.

E. When the County finds that the work is substantially complete:

1. The Engineer shall prepare and deliver to the County a tentative Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a tentative list of the items to be completed or corrected before final payment.
2. The Engineer shall consider any objections made by the County as provided in Conditions of the Contract. When the Engineer considers the work substantially complete, he will execute and deliver to the County a definite Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

A. When the Contractor considered the work to be complete, he shall submit written certification stating that:

1. The Contract Documents have been reviewed.
2. The work has been inspected for compliance with Contract Documents.
3. The work has been completed in accordance with Contract Documents.
4. The equipment and systems have been tested in the presence of the County's

representative and are operational.
5. The work is completed and ready for final inspection.

B. The County shall make an inspection to verify the status of completion after receipt of such certification.

C. If the County determines that the work is incomplete or defective:

1. The County shall promptly notify the Contractor in writing, listing the incomplete or defective work.
2. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to County that the work is complete.
3. The County shall reinspect the work.

D. Upon finding the work to be acceptable under the Contract Documents, the County shall request the Contractor to make closeout submittals.

E. For each additional inspection beyond a total of three (3) inspections for substantial and final completion due to the incompleteness of the work, the Contractor shall reimburse the County's fees.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO COUNTY

A. Project Record Documents (prior to substantial completion).

B. Operation and maintenance manuals (prior to substantial completion).

C. Warranties and Bonds.

D. Evidence of Payment and Release of Liens: In accordance with requirements of General and Supplementary Conditions.

E. Certification letter from Florida Department of Transportation and Manatee County Department of Transportation, as applicable.

F. Certificate of Insurance for Products and Completed Operations.

G. Final Reconciliation, Warranty Period Declaration, and Contractor's Affidavit (Manatee County Project Management Form PMD-9).

1.05 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the County.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:
    a. Previous Change Orders
    b. Unit Prices
    c. Penalties and Bonuses
    d. Deductions for Liquidated Damages

e. Other Adjustments

3. Total Contract Sum, as adjusted.
4. Previous payments.
5. Sum remaining due.

C. Project Management shall prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.06 FINAL APPLICATION FOR PAYMENT

Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01710 CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Execute cleaning during progress of the work and at completion of the work, as required by the General Conditions.

1.02 DISPOSAL REQUIREMENTS

Conduct cleaning and disposal operations to comply with all Federal, State and Local codes, ordinances, regulations and anti-pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulation of waste materials, rubbish and wind-blown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

C. Prior to final completion or County occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire work is clean.

END OF SECTION

SECTION 01720 PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor shall maintain at the site for the County one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. County's field orders or written instructions.
6. Approved shop drawings, working drawings and samples.
7. Field test records.
8. Construction photographs.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the County.

1.03 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the County.

1.04 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with construction progress.

C. Do not conceal any work until required information is recorded.

D. Drawings; Legibly mark to record actual construction:

1. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc. Locations of drainage ditches, swales, water lines and

force mains shall be shown every 200 feet (measured along the centerline) or alternate lot lines, whichever is closer. Dimensions at these locations shall indicate distance from centerline of right-of-way to the facility.

2. Field changes of dimension and detail.
3. Changes made by Field Order or by Change Order.
4. Details not on original contract drawings.
5. Equipment and piping relocations.
6. Locations of all valves, fire hydrants, manholes, water and sewer services, water and force main fittings, underdrain cleanouts, catch basins, junction boxes and any other structures located in the right-of-way or easement, shall be located by elevation and by station and offset based on intersection P.I.'s and centerline of right-of-way. For facilities located on private roads, the dimensioning shall be from centerline of paving or another readily visible baseline.
7. Elevations shall be provided for all manhole rim and inverts; junction box rim and inverts; catch basin rim and inverts; and baffle, weir and invert elevations in control structures. Elevations shall also be provided at the PVI's and at every other lot line or 200 feet, whichever is less, of drainage swales and ditches. Bench marks and elevation datum shall be indicated.
8. Slopes for pipes and ditches shall be recalculated, based on actual field measured distances, elevations, pipe sizes, and type shown. Cross section of drainage ditches and swales shall be verified.
9. Centerline of roads shall be tied to right-of-way lines. Elevation of roadway centerline shall be given at PVI's and at all intersections.
10. Record drawings shall show bearings and distances for all right-of-way and easement lines, and property corners.
11. Sidewalks, fences and walls, if installed at the time of initial record drawing submittal, shall be located every 200 feet or alternate lot lines, whichever is closer. Dimensions shall include distance from the right-of-way line and the back of curb and lot line or easement line.
12. Sanitary sewer mainline wyes shall be located from the downstream manhole. These dimensions shall be provided by on-site inspections or televiewing of the sewer following installation.
13. Elevations shall be provided on the top of operating nuts for all water and force main valves.
14. Allowable tolerance shall be ± 6.0 inches for horizontal dimensions. Vertical dimensions such as the difference in elevations between manhole inverts shall have an allowable tolerance of ± 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum tolerance of ± 2 inch.
15. Properly prepared record drawings on mylar, together with two copies, shall be certified by a design professional (Engineer and/or Surveyor registered in the State of Florida), employed by the Contractor, and submitted to the County.

E. Specifications and Addenda; Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
2. Changes made by field order or by change order.

F. Shop Drawings (after final review and approval):

1. Five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

1.05 SUBMITTAL

A. Prior to substantial completion and prior to starting the bacteria testing of water lines, deliver signed and sealed Record Documents and Record Drawings to the County. These will be reviewed and verified by the inspector. If there are any required changes or additions, these shall be completed and the entire signed and sealed set resubmitted prior to final pay application.

B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings. Record drawings shall be certified by the professional(s) (Engineer or Surveyor licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and sealed paper drawings, signed and dated mylar drawings together with an AutoCAD version on a recordable compact disk (CD).

C. The CD shall contain media in AutoCad Version 2012, or in any other CAD program compatible with AutoCad in DWG or DXF form. All fonts, line types, shape files or other pertinent information used in the drawing and not normally included in AutoCad shall be included on the media with a text file or attached noted as to its relevance and use.

D. Accompany submittal with transmittal letter, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each Record Document.
5. Signature of Contractor or his authorized representative.

Note: The data required to properly prepare these record drawings shall be obtained at the site, at no cost to the County by the responsible design professional or his/her duly appointed representative. The appointed representative shall be a qualified employee of the responsible design professional or a qualified inspector retained by the responsible design professional on a project-by-project basis.

PART 2 STANDARDS

2.01 MINIMUM RECORD DRAWING STANDARDS FOR ALL RECORD DRAWINGS SUBMITTED TO MANATEE COUNTY

A. Record drawings shall be submitted to at least the level of detail in the contract documents. It is anticipated that the original contract documents shall serve as at least a background for all record information. Original drawings in CAD format may be requested of the County.

B. Drawings shall meet the criteria of paragraph 1.04 D above.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01730 OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile product data and related information appropriate for County's maintenance and operation of products furnished under Contract.

Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.

B. Instruct County's personnel in maintenance of products and equipment and systems.

C. Provide three (3) sets of operating and maintenance manuals for each piece of equipment provided within this Contract.

1.02 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by County's personnel.

B. Format:

1. Size: 8-1/2 inch x 11 inch
2. Paper: 20 pound minimum, white, for typed pages
3. Text: Manufacturer's printed data or neatly typewritten
4. Drawings:
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold larger drawings to size of text pages.
5. Provide fly-leaf for each separate product or each piece of operating equipment.
   a. Provide typed description of product and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
   a. Title of Project.
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality three-ring binders with durable and cleanable plastic covers.
2. Maximum ring size: 1 inch.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.03 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.
    a. Function, normal operating characteristics and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replaceable parts.
2. Operating Procedures:
    a. Start-up, break-in, routine and normal operating instructions.
    b. Regulation, control, stopping, shut-down and emergency instructions.
    c. Summer and winter operating instructions.
    d. Special operating instructions.
3. Maintenance Procedures:
    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Alignment, adjusting and checking.
4. Servicing and lubricating schedule.
    a. List of lubricants required.
5. Manufacturer's printed operating and maintenance instructions.
6. Description of sequence of operation by control manufacturer.
7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    a. List of predicted parts subject to wear.
    b. Items recommended to be stocked as spare parts.
8. As installed control diagrams by controls manufacturer.
9. Each contractor's coordination drawings.
    a. As installed color coded piping diagrams.
10. Charts of valve tag numbers, with location and function of each valve.
11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
12. Other data as required under pertinent sections of specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.
    a. Function, normal operating characteristics and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replaceable parts.
2. Circuit directories of panelboards.
    a. Electrical service.
        b. Controls.
    c. Communications.
3. As-installed color coded wiring diagrams.
4. Operating procedures:
    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.
5. Maintenance procedures:
    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Adjustment and checking.
6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacture's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
8. Prepare and include additional data when the need for such data becomes apparent during instruction of County's personnel.

D. Prepare and include additional data when the need for such data becomes apparent during instruction on County's personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.04 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form fifteen days prior to substantial completion.

1. Copy will be returned after substantial completion, with comments (if any).

B. Submit two copies of approved data in final form. Final acceptance will not be provided until the completed manual is received and approved.

1.05 INSTRUCTION OF COUNTY'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct County's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction.

1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01740 WARRANTIES AND BONDS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to County for review and transmittal.

1.02 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product or work item.
2. Firm, with name of principal, address and telephone number.
3. Scope.
4. Date of beginning of warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service maintenance contract.
6. Provide information for County's personnel:
    a. Proper procedure in case of failure.
    b. Instances which might affect the validity of warranty or bond.
7. Contractor, name of responsible principal, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inch x 11 inch punched sheets for standard 3-ring binder. Fold larger sheets to fit into binders.
2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
    a. Title of Project.
    b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. Make submittals within ten days after date of substantial completion and prior to final request for payment.

B. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.05 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in respective sections of Specifications.

B. Approval by the County of all documents required under this section is a pre-requisite to requesting a final inspection and final payment

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 2 SITE WORK

SECTION 02064 MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to modify, alter and/or convert existing structures as shown or specified and as required for the installation of piping, mechanical equipment and appurtenances. Existing piping and equipment shall be removed and dismantled as necessary for the performance of facility alterations in accordance with the requirements herein specified.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the Contract Drawings, herein specified, or necessary to permit completion of the work under this Contract. The Contractor shall dispose of surplus materials resulting from the above work in an approved manner. The work shall include all necessary cutting and bending of reinforcing steel, structural steel, or miscellaneous metal work found embedded in the existing structures.

B. The Contractor shall dismantle and remove all existing equipment, piping, and other appurtenances required for the completion of the work. Where called for or required, the contractor shall cut existing pipelines for the purpose of making connections thereto. Anchor bolts for equipment and structural steel removed shall be cut off one inch below the concrete surface. Surface shall be finished as specified in the Contract Documents.

C. At the time that a new connection is made to an existing pipeline, additional new piping, extending to and including a new valve, shall be installed. Pipe anchorage, if required, is part of the installation shall also be installed as directed by the County.

D. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except with the express approval of and to the extent approved by the County.

E. When removing materials or portions of existing utility pipelines and/or structures or when making openings in walls and partitions, the Contractor shall take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, and not to damage the structures or contents by falling or flying debris. Unless otherwise permitted, line drilling will be required in cutting existing concrete.

F. Materials and equipment removed in the course of making alterations and additions shall remain the property of the County, except that items not salvageable, as determined by the County, shall become the property of the Contractor to be disposed of by him off the work site at his own place of disposal. Operating equipment shall be thoroughly cleaned, lubricated, and greased for protection during prolonged storage.

G. All alterations to existing utility pipes and structures shall be done at such time and in such manner as to comply with the approved time schedule. So far as possible before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delay.

H. All workmanship and new materials involved in constructing the alterations shall conform to the General Specifications for the classes of work insofar as such specifications are applicable.

I. All cutting of existing concrete or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these Specifications covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the Resident Project Representative.

J. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.

K. Non-shrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown.

L. Where necessary or required for the purpose of making connections, the Contractor shall cut existing pipelines in a manner to provide an approved joint. Where required, he shall use flanges, or provide Dresser Couplings, all as required.

M. The Contractor shall provide flumes, hoses, piping and other related items to divert or provide suitable plugs, bulkheads, or other means to hold back the flow of water or other liquids, all as required in the performance of the work under this Contract.

N. Care shall be taken not to damage any part of existing buildings or foundations or outside structures.

3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT

The Contractor shall verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the Drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection. A Manatee County representative must be present for all tie-ins for a visual inspection.

3.03 REMOVAL AND ABANDONMENT OF ASBESTOS CEMENT PIPE AND APPURTENANCES

A. All work associated with the removal or abandonment of existing asbestos cement pipe and appurtenances shall be performed by a licensed asbestos abatement contractor or subcontractor registered in the State of Florida. After removal of the facilities, all trenches shall be backfilled in accordance with the Contract Documents. The cost of disposing of

the removed materials shall be borne by the Contractor.

B. The asbestos abatement contractor or subcontractor shall contact the appropriate regulatory agencies prior to removal or abandonment of any asbestos material and shall obtain all required permits and licenses and issue all required notices. The Contractor shall be responsible for all fees associated with permits, licenses and notices to the governing regulatory agencies. An asbestos manifest form must accompany each and every shipment of such pipe or pipe material waste to the Manatee County Lena Road Landfill. Prior to each shipment, a minimum of 24 hours' notice to the Landfill field office (Phone #748-5543) is required.

C. All work associated with removal or abandonment of asbestos cement pipe and appurtenances shall be performed in accordance with the standards listed below and all other applicable local, State, or Federal standards.

1. Florida Administrative Code, Chapter 62-257, "Asbestos Program".
2. National Emission Standards Hazardous Air Pollution (NESHAP), 40 CFR, Part 61, Subpart M, latest revision.
3. Occupational Safety and Health Act, 29 CFR, 1910.1001 – Asbestos.
4. Title 40 CFR, Part 763, Asbestos.
5. Florida Statute Title XXXII, Chapter 469, Asbestos Abatement.

3.04 IN-PLACE GROUTING OF EXISTING PIPE

A. Where water and wastewater utility pipes are to be abandoned in place, they shall be filled with a sand/cement grout as specified herein. When such pipes are constructed with asbestos cement materials, the abandonment activities shall be performed by a licensed asbestos abatement contractor as specified in these Specifications.

B. Grout shall be injected within the pipe sections indicated on the Drawings. The ends of these sections shall be capped and/or plugged. The grouting program shall consist of pumping sand-cement grout with suitable chemical additives at pressures necessary to fill the pipe sections shown on the Drawings to prevent the potential for future collapse.

C. The pump used for grouting should be a continuous flow, positive displacement model with a pugmill type mixing vat having a minimum shaft speed of 60 rpm and incorporated as an integral part of the equipment. Alternate equipment may be used subject to the approval of the County. The rate of pumping shall not exceed six (6) cubic feet per minute. The pumping pressures shall be in the range of 100 to 150 psi.

D. The Contractor shall provide standpipes and/or additional means of visual inspection as required by the County to determine if adequate grout material has filled the entire pipe section(s). The Contractor shall make necessary provisions for the County's representative to monitor all grouting operations.

E. All pipe to be abandoned shall be capped or plugged with a fitting or material that will prevent soil or other material from entering the pipe. All caps and plugs shall be subject to approval by the County.

END OF SECTION

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SECTION 02100 SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers clearing, grubbing and stripping of the project site and/or along the pipeline route.

B. The Contractor shall clear and grub all of the area within the limits of construction or as required, which includes, but is not limited to utility easements. The width of the area to be cleared shall be reviewed by the County prior to the beginning of any clearing.

C. The Contractor's attention is directed to any Soil Erosion and Sediment Control Ordinances in force in Manatee County. The Contractor shall comply with all applicable sections of these ordinances.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

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, trees shall be preserved as hereinafter specified unless otherwise designated by the County. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, so as to provide for the safety of employees and others. Soil erosion control devices such as hay bales and silt fences shall be installed to satisfy all Federal, State and County requirements.

3.02 GRUBBING

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.

3.03 STRIPPING

In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. The County shall have the option to receive all excess topsoil materials. The Contractor shall pay all equipment and labor cost to deliver excess top soil material to a remote site chosen by the County within a five mile radius of the construction site. Should County not choose to receive any or all excess topsoil materials, the Contractor shall dispose of said material at no additional cost to County.

3.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris off site. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.05 PRESERVATION OF TREES

Those trees which are not designated for removal by the County shall be carefully protected from damage. The Contractor shall erect such barricades, guards and enclosures as may be considered necessary by him for the protection of the trees during all construction operation.

3.06 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property adjacent to proposed project site. Trees, shrubbery, gardens, lawns and other landscaping, which are not designated by the County to be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.

B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.

C. Improvements to the land such as fences, walls, outbuildings and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship.

D. The Contractor shall clean up the construction site across developed private property directly after construction is completed upon approval of the County.

3.07 PRESERVATION OF PUBLIC PROPERTY

The appropriate paragraphs of these Specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements and all other damaged areas. This includes, but is not limited to the trimming of trees damaged by contractor's equipment.

END OF SECTION

SECTION 02220 EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Structural excavation shall consist of the removal of material for the construction of foundations for structures and other excavation designated on the drawings or in these specifications.

B. Structural excavation and backfill shall consist of furnishing material, if necessary and placing and compacting backfill material around structures to the lines and grades designated on the drawings, as specified or directed by the County.

C. Structural excavation and backfill shall include the furnishing of all materials, equipment and other facilities which may be necessary to perform the excavations, place and compact the backfill, install sheeting and bracing, and carry out any necessary dewatering. It shall also include the wasting or disposal of surplus excavated material in a manner and in locations approved by the County.

D. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to, protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 QUALITY ASSURANCE

A. Testing Agency:

1. In place soil compaction tests shall be performed by a qualified testing laboratory.
2. Compaction tests shall be taken every 500 feet, except in the road crossings or road shoulders. Tests are to be taken according to current FDOT Standards.

B. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM D1557, Moisture-Density Relations of Soils Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.

1.03 JOB CONDITIONS

A. The Contractor shall provide, operate and maintain all necessary pumps, discharge lines, well points, etc., in sufficient number and capacity to keep all excavation, bases, pits, etc., free from seepage, standing or running water at all times throughout the period of construction.

B. The Contractor shall assume all responsibility for the security of the excavation required, employing bracing, lining or other accepted means necessary to accomplish same.

C. Excavated areas shall be cleared of all debris, water, slush, muck, clay and soft or loose earth and shall be conditioned to the entire satisfaction of the County.

D. All excavated material unsuitable for use or which will not be used shall be disposed of in a manner consistent with State and County regulation.

E. All unsuitable organic materials, roots, logs, etc., found during excavation shall be removed by the Contractor and the trench shall be refilled with suitable material.

PART 2 PRODUCTS

2.01 MATERIAL FOR CONTROLLED FILL

A. Composition: Only approved material free from organic matter and lumps of clay, shall be used for backfill. Excavated earth free from debris or organic material may be used for backfilling foundations or fill.

B. Crushed stone and shell shall meet or exceed current FDOT Standards.

2.02 UNSUITABLE MATERIAL

Unsuitable material shall be defined as highly organic soil per ASTM D2487 Group PT. This includes, but is not limited to, such items as topsoil, roots, vegetable matter, trash, debris, and clays that cannot be dried sufficiently to obtain specified compaction.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall verify that work preceding the affected work of this Section has been satisfactorily completed.

B. Conditions adversely affecting the work of this Section shall be corrected to the satisfaction of the County.

3.02 REMOVAL OF UNSUITABLE MATERIALS

A. The Contractor shall remove unsuitable material from within the limits of the Work.

B. Materials meeting requirements for controlled fill shall be stockpiled as necessary and in such a manner satisfactory to the County.

C. All material excavated shall be placed so as to minimize interference with public travel and to permit proper access for inspection of the work.

3.03 EXCAVATION

A. When concrete or shell subbase footing is to rest on an excavated surface, care shall be taken not to disturb the natural soil. Final removal and replacement of the foundation material and subbase compaction to grade shall not be made until just before the concrete or masonry is placed.

B. When any structural excavation is completed, the Contractor shall notify the County who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the County.

C. The elevations of the footing bottom and the base slab as shown on the Drawings, shall be considered as approximate and the County may order in writing, such changes in dimensions or elevations of the footings and slab base as necessary to secure satisfactory foundations.

D. All excavation shall be made within an area bounded by lines five feet outside and parallel to the exterior walls of the structure to allow for correct forming, shoring and inspection of foundation work. Pouring of concrete against earth side walls shall not be permitted.

E. If the ground is excavated below the grade called for by the Drawings or becomes unstable due to the Contractor's carelessness or operations, the ground shall be excavated to undisturbed native soil before continuing concreting operations.

F. If in the opinion of the County, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the County and if so directed, replaced by crushed stone or washed shell.

3.04 STRUCTURAL BACKFILL

A. Structural backfill shall not be placed until the footings or other portions of the structure or facility have been inspected by the County and approved for backfilling.

B. A minimum of 1-1/2" layer of lean concrete shall be placed as a working mat for the concrete base slabs and footings if required by the County.

C. Fill shall be placed in uniform layers not more than 12" thick and compacted to a minimum of 98 percent of the maximum density determined by ASTM D1557, Method A or C, or as directed by the County. The Contractor shall securely tamp the backfill with pneumatic rammer around all wall foundations. The method of compaction shall be satisfactory to the County.

D. Compaction of structural backfill by ponding and jetting may be permitted when, as determined by the County: the backfill material is of such character that it will be self-draining when compacted; foundation materials will not soften or be otherwise damaged by the applied water; no damage from hydrostatic pressure will result to the structure. Ponding and jetting within two feet below finished subgrade shall not be permitted in roadway areas. At the discretion of the County, ponding and jetting may be permitted with compaction layers not to exceed four feet.

E. Surplus material not used on-site shall be removed and disposed of off-site by the Contractor. In no case shall surplus material be deposited on adjacent lands. Fill used for grading shall be placed in layers not to exceed 12 inches in thickness and shall be compacted to a density equal or greater to that of the surrounding natural ground.

3.05 BACKFILLING AROUND STRUCTURES

A. Common fill and structural fill are specified for use as backfill against the exterior walls of the structures. Fill shall be placed in layers having a maximum thickness of eight (8)

inches in loose state and shall be compacted sufficiently to prevent settlement. If compaction is by rolling or ramming, material shall be wetted down as required. Where material can be suitably compacted by jetting or puddling, the Contractor may use one of these methods. No boulders shall be allowed to roll down the slopes and hit the walls.

B. Backfilling shall be carried up evenly on all walls of an individual structure simultaneously. A variation of two (2) feet in elevation will be the maximum allowable. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength. Backfilling shall be subjected to approval by the County.

C. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the refill up to an elevation of at least one foot above the bottom of the pipes:

1. Place structural fill in such areas for a distance of not less than three feet either side of the center line of the pipe in level layers not exceeding 6-inches in depth.
2. Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the County.
3. Structural fill shall be of the quality specified under Part 2 of this Section.

D. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan. No soft spots or uncompacted areas shall be allowed in the work.

E. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

3.06 FIELD QUALITY CONTROL

A. The density of soil in place shall be a minimum of 95 percent in accordance with ASTM test 1557-70T, Method A or C.

END OF SECTION

SECTION 02221 TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not be limited to: vaults; duct conduit; pipe; roadways and paving; backfilling; required fill or borrow operations; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and dewatering.

B. Prior to commencing work, the Contractor shall examine the site and review test borings if available, or undertake his own subsurface investigations and take into consideration all conditions that may affect his work.

C. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 PROTECTION

A. Sheeting and Bracing in Excavations:

1. In connection with construction of underground structures, the Contractor shall properly construct and maintain cofferdams. These shall consist of: sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing yard pipe and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
2. Trench sheeting for pipes: no sheeting is to be withdrawn if driven below, mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the County. During the progress of the work, the County may direct the Contractor in writing to leave additional wood sheeting in place. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.
3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specification, all sheeting and bracing shall be removed after completion of the piping or structure, care being taken not to disturb or otherwise injure the pipeline or finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specifically made for that purpose, by watering, or as may otherwise be directed.

4. The Contractor shall construct, to the extent he deems it desirable for his method of operation, the cofferdams and sheeting outside the neat lines of the pipeline trench or foundation unless otherwise indicated on the Drawings or directed by the County. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the pipeline or structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the pipeline or the enclosed masonry. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.
5. Drawings of the cofferdams and design computations shall be submitted to the County and approved prior to any construction. However, approval of these drawings shall not relieve the Contractor of the responsibility for the cofferdams. The drawings and computations shall be prepared and stamped by a Registered Professional Engineer in the State of Florida and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the pipeline and substructures.

B. Dewatering, Drainage and Flotation

1. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding rock and limerock base course, in-the-dry. In addition, the Contractor shall make the final 24" of excavation for this work in-the-dry and not until the water level is a minimum of 6" below proposed bottom of excavation.
2. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavation and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
3. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
4. Wellpoints may be required for dewatering the soil prior to final excavation for deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to avoid the structure, pipeline, or fill from becoming floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
5. The Contractor shall furnish all materials and equipment to perform all work required to install and maintain the proposed drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.
6. Where required, the Contractor shall provide a minimum of two operating groundwater observation wells at each structure to determine the water level during construction of the pipeline or structure. Locations of the observation wells shall be at structures and along pipelines as approved by the County prior to their installation. The observation wells shall be extended to 6 inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base and left in place at the completion of this Project.
7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the County for approval. Such

approval shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils for damage to pipeline or structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.

8. As part of his request for approval of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one quart sample. Discharge water shall not flow directly into wetlands or Waters of the State as defined by FDEP and SWFWMD.
9. During backfilling and construction, water levels shall be measured in observation wells located as directed by the County.
10. Continuous pumping will be required as long as water levels are required to be below natural levels.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as fill and backfill shall be described below. For each material, the Contractor shall notify the County of the source of the material and shall furnish the County, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.
2. Additional materials shall be furnished as required from off-site sources and hauled to the site.

B. Structural Fill

1. Structural fill in trenches shall be used below spread footing foundations, slab-on-grade floors and other structures as backfill within three feet of the below grade portions of structures.
2. Structural fill material shall be a minimum of 60 percent clean sand, free of organic, deleterious and/or compressible material. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180. Rock in excess of 2-1/2" in diameter shall not be used in the fill material. If the moisture content is improper for attaining the specified density, either water shall be added or material shall be permitted to dry until the proper moisture content for compaction is reached.

C. Common Fill

1. Common fill material shall be free from organic matter, muck or marl and rock exceeding 2-1/2" in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials. Existing soil may be used to adjust grades over the site with the exception of the construction area.
2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the County, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

D. Crushed Stone

1. Crushed stone may be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the Drawings.
2. Crushed stone shall be size No. 57 with gradation as noted in Table 1 of Section 901 of Florida Department of Transportation, Construction of Roads and Bridges.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION AND BACKFILLING

A. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches.

B. Rock shall be removed to a minimum 6" clearance around the bottom and sides of all the pipe or ducts being laid.

C. Where pipes or ducts are to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually, shall be done in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

E. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.

F. Backfilling over ducts shall begin not less than three days after placing concrete encasement.

G. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.

H. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than 2" and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe.

I. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.

J. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted by rolling, ramming, or puddling, as the County may direct, sufficiently to prevent subsequent settling.

END OF SECTION

SECTION 02223 EXCAVATION BELOW GRADE AND CRUSHED STONE OR SHELL REFILL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. If in the opinion of the County, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the County and replaced by crushed stone or washed shell.

PART 2 PRODUCTS (NOT USED)

PART 3 MATERIALS

3.01 EXCAVATION AND DRAINAGE

A. Whatever the nature of unstable material encountered or the groundwater conditions, trench stabilization shall be complete and effective.

B. Should the Contractor excavate below the grade shown on the Contract drawings because of negligence or for his own convenience; due to failure in properly dewatering the trench; disturbs the subgrade before dewatering is sufficiently complete; he shall be directed by the County to excavate below grade. The work of excavating below grade and furnishing and placing the approved refill material shall be performed at the Contractor's expense.

3.02 REFILL

A. Should the material at the level of trench bottom consist of fine sand, sand and silt or soft earth, the subgrade material shall be removed as directed by the County and the excavation shall be refilled with crushed stone or washed shell.

END OF SECTION

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SECTION 02260 FINISH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

A. The Contractor shall finish grade sub-soil.

B. The Contractor shall cut out areas to receive stabilizing base course materials for paving and sidewalks.

C. The Contractor shall place, finish grade and compact top soil.

1.02 PROTECTION

The Contractor shall prevent damage to existing fencing, trees, landscaping, natural features, bench marks, pavement and utility lines. Damage shall be corrected at no cost to the County.

PART 2 PRODUCTS

A. Topsoil: Shall be friable loam free from subsoil, roots, grass, excessive amount of weeds or other organics, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter. The Contractor may use topsoil stockpiles on site if they conform to these requirements.

PART 3 EXECUTION

3.01 SUB-SOIL PREPARATION

A. The Contractor shall rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Uneven areas and low spots shall be eliminated. Debris, roots, branches or other organics, stones, and sub-soil shall be removed by the Contractor and disposed of in a manner consistent with the latest Manatee County Standards as well as any affected regulatory agency. Should contaminated soil be found, the Contractor shall notify the County.

B. The Contractor shall cut out areas to sub-grade elevation to stabilize base material for paving and sidewalks.

C. The Contractor shall bring sub-soil to required profiles and contour graces gradually; and blend slopes into level areas.

D. The Contractor shall slope the structure grade a minimum of two (2) inches in ten (10) feet unless indicated otherwise on the Drawings.

E. The Contractor shall cultivate sub-grade to a depth of 3 inches where the topsoil is to be placed. He shall repeat cultivation in areas where equipment use has compacted sub-soil.

F. The Contractor shall not make grade changes which causes water to flow onto adjacent

lands.

3.02 PLACING TOPSOIL

A. The Contractor shall place topsoil in areas where seeding, sodding and planting is to be performed. He shall place from the following minimum depths, up to finished grade elevations:

1. 6 inches for seeded areas
2. 4-1/2 inches for sodded areas
3. 24 inches for shrub beds
4. 18 inches for flower beds

B. The Contractor shall use topsoil in a dry state as determined by the County. He shall place the material during dry weather.

C. The Contractor shall use fine grade topsoil eliminating rough and low areas to ensure positive drainage. He shall maintain levels, profiles and contours of the sub-grades.

D. The Contractor shall remove stone, roots, grass, weeds, debris, and other organics or foreign material while spreading the material.

E. The Contractor shall manually spread topsoil around trees, plants and structures to prevent damage which may be caused by grading equipment.

F. The Contractor shall lightly compact and place the topsoil.

3.03 SURPLUS MATERIAL

A. The Contractor shall remove surplus sub-soil and topsoil from site at his expense.

B. The Contractor shall leave stockpile areas and entire job site clean and raked, ready for landscaping operations.

END OF SECTION

SECTION 02276 TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of the design, provision, maintenance and removal of temporary erosion and sedimentation controls as necessary.

B. Temporary erosion controls include, but are not limited to: grassing, mulching, netting, watering, and the reseeding of on-site surfaces and spoil and borrow area surfaces, interceptor ditches at ends of berms and other such work at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the County.

C. Temporary sedimentation controls include, but are not limited to: silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which shall ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the County.

D. The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.02 REFERENCE DOCUMENTS

A. Florida Building Code.

B. FDEP/COE Dredge and Fill Regulations and/or Permit as applicable.

C. SWFWMD Permit Regulations and/or Permit as applicable.

D. Florida Stormwater, Erosion and Sedimentation Control Inspector’s Manual.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Netting - fabricated of material acceptable to the County.

B. Seed and sod.

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seed free cereal hay type.

B. Netting - fabricated of material acceptable to the County.

C. Filter stone - crushed stone conforming to Florida Dept. of Transportation specifications.

D. Concrete block - hollow, non-load-bearing type.

E. Concrete - exterior grade not less than one inch thick.

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures for grassing shall be:

1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.
4. Apply netting over mulched areas on sloped surfaces.
5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

A. The Contractor shall install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Deteriorated hay bales and dislodged filter stone shall be replaced by the Contractor at his expense.

3.03 PERFORMANCE

A. The Contractor, at his own expense, shall immediately take whatever steps are necessary to correct any deficiencies of the temporary erosion and sediment control measures employed if they fail to produce results or do not comply with the requirements of the State of Florida or any other federal, governmental or regulatory agency.

END OF SECTION

SECTION 02480 LANDSCAPING

PART 1 GENERAL

1.10 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to install trees, ground cover, and shrubs, to place accessory planting materials, to maintain and guarantee all planted areas. All work shall be in strict accordance with sound nursery practice and shall include maintenance and watering of all of the work of this Contract until final completion and acceptance by the County.

B. The landscaping shall be performed by a contractor or subcontractor who specializes in landscaping and who is fully familiar and experienced in projects of this type and scope. The landscaping contractor or subcontractor shall be subject to the approval of the County.

C. The Contractor shall provide all landscaping complete and ready for use as specified in the Contract Documents and as shown on the Drawings.

1.02 SUBMITTALS

A. The Contractor shall submit to the County for review and approval, shop drawings and complete written maintenance instructions for each type of plant furnished under this Contract.

B. The Contractor shall submit representative samples of any or all of required accessory planting materials as requested by the County.

1.03 OBSTRUCTIONS BELOW GROUND

A. The County may change the location of plant material if underground construction, utilities or obstructions are encountered in excavation of planting areas or pits.

B. The Contractor shall make such changes without additional compensation from the County.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plant species and size shall conform to those indicated in the Plant List and in plan locations shown on the Drawings. Nomenclature shall conform to the Florida Department of Agriculture: "Grades and Standards for Nursery Plants". The designated authority for identification of plants shall be in conformance with FDOT Standard Specification Section 580-2.1.1 Plants.

B. Plants shall be sound, healthy, vigorous, free from plant diseases, insects, pests, or their eggs and shall have healthy normal root systems. Plants shall be nursery grown stock, freshly dug. No heeled in, cold storage, or collected stock shall be accepted.

C. Shape and Form

1. Plant material shall be symmetrical, typical for the variety and species, and shall conform to the measurements specified in the Plant List.
2. Plants used where symmetry is required shall be matched as nearly as possible.
3. Plants shall not be pruned prior to delivery except as authorized by the County.
4. All plants shall have been transplanted or root pruned at least once in the past three years.
5. Unless otherwise noted, street trees shall be free of branches up to six feet, with the single leader well branched, and with straight trunks.
6. Shrubs shall have been transplanted twice, have fully developed root systems, be heavily canned with foliage to base, fulfill dimensions required, and be typical of species.
7. Ground covers shall have sturdy fibrous root systems and shall be heavily leafed.

D. Measurement: The height and/or width of trees shall be measured from the ground or across the normal spread of branches with the plants in their normal position. This measurement shall not include the immediate terminal growth.

E. Substitutions in plant species or size shall be made only with the written approval of the County.

F Ground cover plants shall be planted in beds of four inches of approved topsoil. The beds shall be thoroughly disked into the soil. The compacted and settled finished surface shall be set to the required grade. Plants shall be spaced as described in the Contract Documents or shown on the Contract Drawings, or otherwise directed by the County in accordance with the best practices of the trade.

G. Planting Soil

1. Soil for backfilling around plants and planting beds shall be a good grade of garden loam as approved by the County. Soil shall be free of heavy clay, coarse sand, stones, lumps, sticks, or other foreign material. The soil shall not be delivered or used in a muddy condition.
2. The soil shall be taken from ground that has never been stripped. There shall be a slight acid reaction to the soil with no excess of calcium or carbonate. The soil shall be free from excess weeds or other objectionable material.
3. Soil for trees and shrubs shall be delivered in a loose, friable condition. All trees shall average approximately one cubic yard per tree, except Sabal Palmetto, which shall be planted with clean sand. There shall be a minimum of 4-inches of planting soil in ground cover areas and 1/8 cubic yard per shrub or vine.
4. No marl shall be allowed in ground cover planting beds.

H. Before plants are backfilled with planting soil, fertilizer tablets, Agriform 20-10-5 or equal, shall be placed in each pit. The Contractor shall provide three tablets for each tree and one for each shrub or vine.

I. Tree Staking: All tree staking and bracing shall be included herein in accordance with sound nursery practice and shall be in accordance with the Contract Documents. The Contractor shall furnish all materials required for staking and bracing as approved.

J. Landscaping stones shall be inert and nonleaching. The Contractor shall provide physical

samples for approval prior to installation. Crushed limerock shall not be acceptable.

PART 3 EXECUTION

3.01 PLANTING PROCEDURES

A. Plant Locations: All plants shall be located as shown on the Drawings, to dimensions if shown, to scale if not dimensioned. Large areas or beds shall be scaled and the plants spaced evenly. Approval by the County is required before any plants may be installed.

B. Tree Pits: Pits for trees shall be at least two feet greater in diameter than the specified diameter of the ball. Pits shall be of sufficient depth to allow a 12-inch layer of planting soil under the ball when it is set to grade. Bottom of pit shall be loosened prior to backfilling.

C. Digging and Handling

1. Plants shall be handled at all times so that roots or balls are adequately protected from sun or drying winds. Tops or roots of plant allowed to dry out will be rejected.
2. Balled and burlapped plants shall be moved with firm, natural balls of soil, not less than one foot diameter of ball to every one inch caliper of trunk, and a depth of not less than 2/3 of ball diameter. No plant shall be accepted when the ball of earth surrounding its roots has been cracked or broken. All trees, except palms, shall be dug with ball and burlapped. Root pruning shall have been done at minimum of four weeks before planting at the job.
3. Bare root plants shall be dug with spread of root and of sufficient depth to insure full recovery of plant.

D. Cabbage Palms (Sable Palmetto):

1. Cabbage Palms shall be taken from moist black sand areas. Only a minimum of fronds shall be removed from the crown to facilitate moving and handling. Clear trunk or overall height shall be as specified after the minimum of fronds have been removed.
2. Cabbage Palms buds shall be tied to a suitable support with a burlap strip, to be left in place until the tree is well established in its new location.
3. Cabbage Palms shall be planted in sand, thoroughly washed in during planting operations, and with a dished or saucer depression left at the soil line for future waterings. Palms with marred or burned trunks will be accepted at the discretion of the County only.
4. Trees moved by winch or crane shall be thoroughly protected from chain marks, girdling or bark slippage by means of burlap, wood battens, or other approved method.

E. When balled or burlapped plants are set, planting soil shall be carefully tamped under and around the base of the balls to prevent voids. All burlap, rope, wires, etc., shall be removed from the sides and tops of balls, but no burlap shall be pulled from underneath. Roots of bare rooted plants shall be properly spread out and planting soil carefully worked in among them.

F. All plants shall be set straight or plumb, in locations shown on the Drawings. Except as otherwise specified, plants shall be planted in pits which shall be set at such level that,

after settlement, they bear the same relation to the finished grade or the surrounding ground as they bore to the grade of the soil from which they are taken.

G. Pruning shall be carefully done by experienced plantsmen. Prune immediately upon acceptance by the County, including any broken branches, thinning small branches and tipping back main branches (except main leaders).

H. Excess soil and debris shall be disposed of off the project site unless ordered stockpiled by the County.

3.02 NORMAL MAINTENANCE OF PLANT MATERIALS

A. Plant material maintenance shall begin when planting operations start and shall extend until final acceptance of work.

B. Maintain all plant materials under this Contract to the satisfaction of the County. Maintenance shall include necessary watering, cultivation, weeding, pruning, spraying, tightening and repair to guy wires, removal of dead material, resetting, and other work required to conform with referenced standards and accepted nursery standards as approved.

C. Plant materials which are in a tilted or in a leaning position shall be properly righted.

D. After final acceptance by the County and until one calendar year after acceptance of all plantings, the landscaping contractor or subcontractor shall make monthly inspections of materials and report in writing to the County the conditions of the plants and the necessary requirements to keep the plants in a healthy growing condition.

3.03 TREE AND PLANT PROTECTION

A. The Contractor shall remove all trees (if any) within the limit of landscaping shown on the detail sheet except those designated to be salvaged (if any). Prior to removal of said trees, the Contractor shall obtain a tree removal permit, if required. All other trees in the vicinity of the work shall be protected against damage by the Contractor until all work under the Contract has been completed.

B. Consult with the County, and remove agreed-on roots and branches which interfere with construction. Employ qualified tree surgeon to remove, and to treat cuts.

C. Provide temporary barriers to a height of six feet around each group of trees and plants.

D. Protect root zones of trees and plants

1. Do not allow vehicular traffic or parking.
2. Do not store materials or products.
3. Prevent dumping or refuse or chemically injurious materials or liquids.
4. Prevent puddling or continuous running water.

E. Carefully supervise excavating, grading, and filling, and subsequent construction operations, to prevent damage.

F. In case of inadvertent damage to any tree or plant by the Contractor or any of his

subcontractors or employees, the Contractor shall provide replacement of each such damaged tree or plant with a new one of acceptable type, size and quality.

G. Completely remove barricades, including foundations, when construction has progressed to the point that they are no longer needed, and when approved by the County.

H. Clean and repair damage caused by installation, fill and grade the areas of the site to required elevations and slopes, and clean the area.

3.04 GUARANTEE

The life and satisfactory condition of all plant material planted shall be guaranteed by the Contractor for a minimum of one calendar year. Guarantee shall include complete replacement with material of the same kind and size as in the original work if not in a healthy condition, as determined by the County, at the end of the guarantee period.

3.05 REPLACEMENT

A. At the end of the guarantee period, any plant required under this Contract that is dead or not in satisfactory growth as determined by the County, shall be removed. Plants replaced shall be guaranteed for 90 days after date of replacement.

B. Replacement of plants necessary during guarantee period shall be the responsibility of the Contractor, except for possible replacements of plants resulting from removal, vandalism, acts of neglect on the part of others, or acts of God.

C. All replacements shall be plants of the same kind and size as specified in the Drawings. They shall be furnished and planted as herein specified. The cost shall be the responsibility of the Contractor.

END OF SECTION

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SECTION 02485 SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials and equipment necessary to satisfactorily return all construction areas to their original conditions or better.

B. Work shall include furnishing and placing seed or sod, fertilizing, planting, watering and maintenance until acceptance by County.

1.02 RELATED WORK NOT INCLUDED

Excavation, filling and grading required to establish elevation shown on the Drawings are included under other sections of these Specifications.

1.03 QUALITY ASSURANCE

A. It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering and seeding or sodding at no additional cost to the County until a satisfactory stand is obtained. For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover over areas to be sodded or seeded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 square yard within a radius of 8 feet.

B. All previously grassed areas where pipelines are laid shall be sodded. All sodding and grassing shall be installed in accordance with these Specifications or as directed by the County.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fertilizer: The fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 8 percent phosphorus, 8 percent potassium; 40 percent other available materials derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitive analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Seeding/Grassing: The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications, Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications, except that no additional payment will be made for mulching, fertilizing and/or watering.

C. Sodding: Sod shall be provided as required on the construction drawings or at locations

as directed by the County in accordance with Florida Department of Transportation, Specifications Section 575 and 981. The Contractor shall furnish bahia grass sod or match existing sod. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575, except that no additional payment will be made for placement and/or watering. This cost shall be included in the Contract price bid for sodding.

D. Topsoil: Topsoil stockpiled during excavation may be used as necessary. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the County. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants and grassing specified herein.

E. Water: It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements that may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.01 INSTALLATION

A. When the trench backfill has stabilized sufficiently, the Contractor shall commence work on lawns and grassed areas, including fine grading as necessary and as directed by the County.

B. Finish Grading: Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated. The County shall approve the finish grade of all areas to be seeded or sodded prior to seed or sod application.

C. Protection: Seeded and sodded areas shall be protected against traffic or other use by placing warning signs or erecting barricades as necessary. Any areas damaged prior to acceptance by the County shall be repaired by the Contractor as directed by the County.

3.02 CLEANUP

Soil or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and sodding operations, all excess soil, stones and debris remaining shall be removed from the construction areas.

3.03 LANDSCAPE MAINTENANCE

A. Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the County.

B. Maintain landscape work for a period of 90 days immediately following complete installation of work or until County accepts project. Watering, weeding, cultivating, restoration of grade, mowing and trimming, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for

live plant material shall be included at no additional cost to the County.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATORS

Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing and sodding, in accordance with these Specifications.

END OF SECTION

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SECTION 02513 ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials and equipment necessary to complete all milling asphalt pavement and asphalt concrete paving (including restoration of driveways) as called out on the Contract Documents or as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Qualifications of Asphalt Concrete Producer: The only materials permitted shall be furnished by a bulk asphalt concrete producer exclusively engaged in the production of hot-mix, hot-laid asphalt concrete.

B. Qualification of Testing Agency: The County may employ a commercial testing laboratory to conduct tests and evaluations of asphalt concrete materials and design. The Contractor shall:

1. Provide asphalt concrete testing and inspection service acceptable to County.
2. Include sampling and testing asphalt concrete materials proposed, and tests and calculations for asphalt concrete mixtures.
3. Provide field testing facilities for quality control testing during paving operations.

C. Requirements of Regulatory Agencies: The Contractor shall comply with the applicable requirements of:

1. Manatee County Utility Operations Department
2. Manatee County Transportation Department
3. State of Florida Dept. of Transportation

1.03 PAVING QUALITY REQUIREMENTS

A. General: In addition to other specified conditions, the Contractor shall comply with the following minimum requirements:

1. In-place asphalt concrete course shall be tested for compliance with requirements for density, thickness and surface smoothness.
2. Final surface shall be provided of uniform texture, conforming to required grades and cross sections.
3. A minimum of four inch diameter pavement specimens for each completed course shall be taken from locations as directed by the County.
4. Holes from test specimens shall be repaved as specified for patching defective work.

B. Density:

1. When subjected to 50 blows of standard Marshall hammer on each side of an in place material specimen, densities shall be comparable to a laboratory specimen of same asphalt concrete mixture.

2. The minimum acceptable density of in-place course material shall be 98% of the recorded laboratory specimen density.

C. Thickness: In-place compacted thicknesses shall not be acceptable if less than the minimum thicknesses shown on the Drawings.

D. Surface Smoothness:

1. Finished surface of each asphalt concrete course shall be tested for smoothness, using a 10 ft. straightedge applied parallel to and at right angles to centerline of paved areas.
2. Surface areas shall be checked at intervals directed by County.
3. Surfaces shall not be acceptable if they exceed the following:
   a. Base Course: 1/4 in. in 10 ft.
   b. Surface Course: 3/16 in. in 10 ft.
   c. Crowned Surfaces:
      (1) Test crowned surfaces with a crown template, centered and at right angles to the crown.
      (2) Surfaces will not be acceptable if varying more than 1/4 in. from the template.

1.04 SUBMITTALS

A. Samples: The Contractor may be required to provide samples of materials for laboratory testing and job-mix design.

B. Test Reports: The Contractor shall submit laboratory reports for following materials tests:

1. Coarse and fine aggregates from each material source and each required grading:
   a. Sieve Analysis: ASTM C 136 (AASHO T 27).
   b. Unit Weight of Slag: ASTM C29 (AASHO T 19).
   c. Soundness: ASTM C 88 (AASHO T 104) for surface course aggregates only.
   d. Sand Equivalent: ASTM D 2419 (AASHO T 176).
   e. Abrasion of Coarse Aggregate: ASTM C131 (AASHO T 96),for surface course aggregates only.
2. Asphalt cement for each penetration grade:
   a. Penetration: ASTM D5 (AASHO T49).
   b. Viscosity (Kinematic): ASTM D2170 (AASHO T 201).
   c. Flash Point: ASTM D92 (AASHO T 48).
   d. Ductility: ASTM D 113 (AASHO T 51).
   e. Solubility: ASTM D 4 (AASHO T 44).
   f. Specific Gravity: ASTM D 70 (AASHO T 43).
3. Job-mix design mixtures for each material or grade:
   a. Bulk Specific Gravity for Coarse Aggregate: ASTM C 117(AASHO T 85).
   b. Bulk Specific Gravity for Fine Aggregate: ASTM C 128(AASHO T 84).
4. Uncompacted asphalt concrete mix: Maximum Specific Gravity: ASTM D 2041 (AASHO T 209).
5. Compacted asphalt concrete mix:
   a. Bulk Density: ASTM D 1188 (AASHO T 166).
   b. Marshall Stability and Flow: ASTM D 1559.
6. Density and voids analysis:

a. Provide each series of asphalt concrete mixture text specimens, in accordance with A.I. MS-2 "Mix Design Methods for Asphalt Concrete".
b. Use Marshall method of mix design unless otherwise directed or acceptable to the County.
c. Report the quantity of absorbed asphalt cement in pounds of dry aggregate, percent air voids, and percent voids in mineral aggregate.

7. Sampling and testing of asphalt concrete mixtures for quality control during paving operations:
   a. Uncompacted asphalt concrete mix.
      (1) Asphalt Cement Content: ASTM D 2172 (AASHO T 164).
      (2) Penetration of Recovered Asphalt Cement: ASTM D 5(AASHO T 49).
      (3) Ductibility of Recovered Asphalt Cement: ASTM D 113(AASHO T 51).
   b. Compacted asphalt concrete mix:
      (1) Bulk Density: ASTM D 1188 (AASHO T 166).
      Marshall Stability and Flow: ASTM D1559).
   c. Perform at least one test for each day's paving.
8. Asphalt plant inspection: ASTM D 290.
9. Additional testing:
   a. Retesting shall be required if previous tests indicate insufficient values, or if directed by the County.
   b. Testing shall continue until specified values have been attained.
10. Asphalt concrete materials which do not comply with specified requirements shall not be permitted in the work.

1.05 JOB CONDITIONS

A. Weather Limitations:

1. Apply bituminous prime and tack coats only when the ambient temperature in the shade is 50 degrees F. and when the temperature has not been below 35 degrees F. for 12 hours immediately prior to application.
2. Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.
3. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.
4. Base course may be placed when air temperature is not below 30 degrees F. and rising, when acceptable to the County.

B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

C. Traffic Control: Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.

PART 2 PRODUCTS

2.01 MATERIALS

A. Soil Cement or Shell Base Course: as specified in FDOT Section 270, "Material for Base

and Stabilized Base", and as called for in the Contract Documents.

B. Aggregate for Asphalt Concrete, General:

1. Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D 692.
2. Sand, stone, or slag screening: ASTM D 1073.
3. Provide aggregate in gradations for various courses to comply with local highway standards.

C. Surface Course Aggregates:

1. Provide natural sand, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions.

D. Asphalt Cement: Comply with ASTM D 946 for 85-100 penetration grade.

E. Prime Coat:

1. Cut-back liquid asphalt.
2. Medium-Curing type: ASTM D 2027, Grade MC-70.

2.02 ASPHALT-AGGREGATE MIXTURES

A. Job-mix criteria:

1. Provide job-mix formulas for each required asphalt-aggregate mixture.
2. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.
3. Comply with the mix requirements of local governing highway standards.
4. Maintain material quantities within allowable tolerances of the governing standards.

2.03 TRAFFIC AND PARKING MARKING MATERIALS

A. Traffic lane marking paint with chlorinated rubber base.

B. Factory mixed, quick drying and non bleeding, FS TT-P-115C, Type III.

C. Color: Driving Lane Dividers - White
No Parking Zone - Yellow
Parking Dividers - White

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Subbase Preparation:

1. The Contractor shall remove from the area all organic substance encountered to a depth of six or eight inches (6" or 8"), or to such depth and width as directed by the County. The entire area shall be plowed and dragged prior to placing a stabilizing

additive, if required to meet minimum bearing value.

2. Subbase shall be compacted to a minimum density of 98 percent of the maximum as determined by the Modified Proctor Density AASHTO T180, and shall have a minimum bearing value of 40 pounds per square inch as determined by the Florida Bearing Test.

B. Base Course:

1. Check subgrade for conformity with elevations and section immediately before placing base material.
2. Place base material in compacted layers not more than 6 inches thick, unless continuing tests indicate the required results are being obtained with thicker layers.
3. In no case will more than 8-inches of compacted base be placed in one lift.
4. Spread, shape, and compact all base material deposited on the subgrade during the same day.
5. Compact base course material to be not less than 95% of maximum density: ASTM D 1557, Method D (98 percent maximum density: AASHTO T-180).
6. Test density of compacted base course: ASTM D 2167.
7 Conduct one test for each 250 sq. yds. of in-place material, but in no case not less than one daily for each layer.

C. Loose and Foreign Material:

1. Remove loose and foreign material from compacted subbase surface immediately before application of paving.
2. Use power brooms or blowers, and brooming as required.
3. Do not displace subbase material.

D. Prime Coat:

1. Uniformly apply at rate of 0.20 to 0.5 gal. per sq. yd. over compacted and cleaned subbase surface.
2. Apply enough material to penetrate and seal, but not flood the surface.
3. Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 24 hours unless otherwise acceptable to the County.
4. Blot excess asphalt with just enough sand to prevent pick-up under traffic.
5. Remove loose sand before paving.

E. Tack Coat:

1. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or Portland cement concrete and similar surfaces.
2. Apply at rate of 0.05 to 0.15 gal. per sq. yd. of surface.
3. Apply tack coat by brush to contact surfaces of structures projecting into or abutting asphalt concrete pavement.
4. Allow surfaces to dry until material is at condition of tackiness to receive pavement.

3.02 MANHOLE FRAME / VALVE BOX ADJUSTMENTS (IF APPLICABLE)

A. Placing Manhole frames:

1. Surround manhole frames set to elevation with a ring of compacted asphalt concrete base prior to paving.
2. Place asphalt concrete mixture up to 1 in. below top of frame, slope to grade, and compact by hand tamping.

B. Adjust manhole frames to proper position to meet paving.

C. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations.

D. Set cover manhole frames to grade, flush with surface of adjacent pavement.

3.03 PREPARING THE MIXTURE

A. Comply with ASTM D 995 for material storage, control, and mixing, and for plant equipment and operation.

B. Stockpiles:

1. Keep each component of the various-sized combined aggregates in separate stockpiles.
2. Maintain stockpiles so that separate aggregate sizes shall not be intermixed.

C. Heating:

1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture
2. Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt.
3. Do not exceed 350 degrees F. (176.6 degrees C.).

D. Aggregate:

1. Heat-dry aggregates to reduce moisture content to not more than 2.0%.
2. Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.
3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements.

E. Mix aggregate and asphalt cement to achieve 90-95% of coated particles for base mixtures and 85-90% of coated particles for surface mixture, when tested in accordance with ASTM D 2489.

F. Transporting:

1. Transport asphalt concrete mixtures from mixing site in trucks having tight, clean compartments.
2. Coat hauling compartments with a lime-water mixture to prevent asphalt concrete mixture from sticking.
3. Elevate and drain compartment of excess solution before loading mix.
4. Provide covers over asphalt concrete mixture when transporting to protect from

weather and to prevent loss of heat.

5. During periods of cold weather or for long-distance deliveries, provide insulation around entire truck bed surfaces.

3.04 EQUIPMENT

A. Provide size and quantity of equipment to complete the work specified within project time schedule.

B. Bituminous Pavers: Self-propelled that spread hot asphalt concrete mixtures without tearing, shoving or gouging surfaces, and control pavement edges to true lines without use of stationary forms.

C. Rolling Equipment:

1. Self-propelled, steel-wheeled and pneumatic-tired rollers that can reverse direction without backlash.
2. Other type rollers may be used if acceptable to the County.

D. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

3.05 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine.

B. Spread mixture at a minimum temperature of 225 degrees F. (107.2 degrees C.).

C. Inaccessible and small areas may be placed by hand.

D. Place each course at thickness so that when compacted, it will conform to the indicated grade, cross-section, finish thickness, and density indicated.

E. Paver Placing:

1. Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.
2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
3. Complete base courses for a section before placing surface courses.
4. Place mixture in continuous operation as practicable.

F. Hand Placing:

1. Spread, tamp, and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to County.
2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.

G. Joints:

1. Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work.
2. Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.
3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.
4. Offset transverse joints in succeeding courses not less than 24 inches.
5. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.
6. Offset longitudinal joints in succeeding courses not less than 6 inches.
7. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

3.06 COMPACTING THE MIX

A. Provide sufficient rollers to obtain the required pavement density.

B. Begin rolling operations as soon after placing when the mixture will bear weight of roller without excessive displacement.

C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.

D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.

F. Do not roll centers of sections first under any circumstances.

G. Breakdown Rolling:

1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
2. Operate rollers as close as possible to paver without causing pavement displacement.
3. Check crown, grade, and smoothness after breakdown rolling.
4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

H. Second Rolling:

1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.
2. Continue second rolling until mixture has been thoroughly compacted.

I. Finish Rolling:

1. Perform finish rolling while mixture is still warm enough for removal of roller marks.
2. Continue rolling until roller marks are eliminated and course has attained specified

density.

J. Patching:

1. Remove and replace defective areas.
2. Cut-out and fill with fresh, hot asphalt concrete.
3. Compact by rolling to specified surface density and smoothness.
4. Remove deficient areas for full depth of course.
5. Cut sides perpendicular and parallel to direction of traffic with edges vertical.
6. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.07 MARKING ASPHALT CONCRETE PAVEMENT

A. Cleaning:

1. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.
2. Do not begin marking asphalt concrete pavement until acceptable to the County.

B. Apply paint with mechanical equipment.

1. Provide uniform straight edges.
2. Not less than two separate coats in accordance with manufacturer's recommended rates.

3.08 CLEANING AND PROTECTION

A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the County.

B. Protection:

1. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than 6 hours.
2. Provide barricades and warning devices as required to protect pavement.
3. Cover openings of structures in the area of paving until permanent coverings are placed (if applicable).

END OF SECTION

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SECTION 02575 PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment, obtain County or State right-of-way permits and incidentals required and remove and replace pavements over trenches excavated for installation of water or sewer lines and appurtenances as shown on the Contract Drawings.

1.02 GENERAL

A. The Contractor shall take before and after photographs.

B. The Contractor shall repair in a manner satisfactory to the County or State, all damage done to existing structures, pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basin, flagstones, or stabilized areas or driveways and including all obstructions not specifically named herein, which results from this Project.

C. The Contractor shall keep the surface of the backfilled area of excavation in a safe traffic bearing condition and firm and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable requirements of Manatee County Transportation Department requirements for pavement repair and as described herein, including all base, subbase and asphalt replacement.

D. All materials and workmanship shall meet or exceed the County requirements and as called for in the Contract Documents and nothing herein shall be construed as to relieve the Contractor from this responsibility.

E. All street, road and highway repair shall be made in accordance with the FDOT and County details indicated on the Drawings and in accordance with the applicable requirements and approval of affected County and State agencies.

PART 2 PRODUCTS

2.01 PAVEMENT SECTION

A. Asphaltic concrete shall consist of asphalt cement, coarse aggregate, fine aggregate and mineral filler conforming to FDOT Type S-III Asphalt. Pavement replacement thickness shall match that removed but in no case shall be less than 1-1/2" compacted thickness. All asphalt concrete pavement shall be furnished, installed and tested in accordance with FDOT Specifications for Road and Bridge Construction.

B. Asphalt or crushed concrete or approved equal base material shall be furnished and installed under all pavement sections restored under this Contract. Asphalt base shall have a minimum 6" compacted thickness, meet requirements for FDOT ABC III (Minimum Marshall Stability of 1000) and be furnished, installed and tested in accordance with the requirements of the FDOT Standards. Crushed concrete base shall be 10" minimum

compacted thickness. Crushed concrete aggregate material shall have a minimum LBR of 140 compacted to 99% T-180 AASHTO density. Asphalt base and crushed concrete base are acceptable. Other bases shall be submitted for approval.

C. Prime and tack will be required and applied in accordance with Section 300 - FDOT Specifications: Prime and Tack Coat for Base Courses.

PART 3 EXECUTION

3.01 CUTTING PAVEMENT

A. The Contractor shall saw cut in straight lines and remove pavement as necessary to install the new pipelines and appurtenances and for making connections to existing pipelines.

B. Prior to pavement removal, the Contractor shall mark the pavement for cuts nearly paralleling pipe lines and existing street lines. Asphalt pavement shall be cut along the markings with a rotary saw or other suitable tool. Concrete pavement shall be scored to a depth of approximately two (2) inches below the surface of the concrete along the marked cuts. Scoring shall be done by use of a rotary saw, after which the pavement may be broken below the scoring with a jackhammer or other suitable equipment.

C. The Contractor shall not machine pull the pavement until it is completely broken and separated along the marked cuts.

D. The pavement adjacent to pipe line trenches shall neither be disturbed or damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, the Contractor shall remove and replace the pavement. In addition, the base and sub-base shall be restored in accordance with these Specifications, Florida Dept. of Transportation Standard Specifications and as directed by the County.

3.02 PAVEMENT REPAIR AND REPLACEMENT

A. The Contractor shall repair, to meet or exceed original surface material, all existing concrete or asphaltic pavement, driveways, or sidewalks cut or damaged by construction under this Contract. He shall match the original grade unless otherwise specified or shown on the Drawings. Materials and construction procedures for base course and pavement repair shall conform to those of the Florida Dept. of Transportation.

B. The Contractor's repair shall include the preparation of the subbase and base, place and maintain the roadway surface, any special requirements whether specifically called for or implied and all work necessary for a satisfactory completion of this work. Stabilized roads and drives shall be finished to match the existing grade. Dirt roads and drives shall have the required depth of backfill material as shown on the Contract Drawings.

C. The width of all asphaltic concrete repairs shall extend the full width and length of the excavation or to the limits of any damaged section. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.03 MISCELLANEOUS RESTORATION

Sidewalks or driveways cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb and gutter shall be restored to the existing height and cross section in full sections or lengths between joints. RCP pipe shall be repaired or installed in accordance with manufacturer's specifications. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass sod of a type matching the existing grass.

3.04 SPECIAL REQUIREMENTS

The restoration of all surfaces, as described herein, disturbed by the installation of pipelines shall be completed as soon as is reasonable and practical. The complete and final restoration of both paved and shell stabilized roads within a reasonable time frame is of paramount importance. To this end, the Contractor shall, as part of his work schedule, complete the restoration of any area of road within five weeks after removing the original surface. Successful leak testing shall be performed prior to restoring any area of road. All restoration and replacement or repairs are the responsibility of the Contractor.

3.05 CLEANUP

After all repair and restoration or paving has been completed, all excess asphalt, dirt and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

3.06 MAINTENANCE OR REPAIR

All wearing surfaces shall be maintained by the Contractor in good order suitable for traffic prior to completion and acceptance of the work.

END OF SECTION

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SECTION 02614 STEEL PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install, complete, ready for operation and field test all steel pipe as shown on the drawings and specified herein.

B. Steel pipe shall include black steel, galvanized steel, and stainless steel pipe and fittings.

C. Provide steel pipe only where specifically called out on the drawings.

1.02 DESCRIPTION OF SYSTEM

A. All of the equipment specified herein is intended to be standard steel pipe for use in transporting certain chemicals and liquids as shown on the drawings and specified herein.

1.03 QUALIFICATIONS

A. All steel pipe shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the steel pipe to be furnished. The equipment shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with all these specifications.

B. Steel pipe and fittings shall conform to all applicable standards of ASTM, ANSI and AWWA.

1.04 SUBMITTALS

A. Submit to the County for approval in accordance with the General Conditions and Section 01340, shop drawings to include dimensioning and technical specifications for all pipe to be furnished.

PART 2 MATERIALS

2.01 STEEL PIPE AND FITTINGS FOR PIPING

A. Black Steel Pipe: All black steel pipe shall be seamless, Grade B and in conformance with ASTM Designation A-53 and ANSI B36.10.

B. Galvanized Steel Pipe:

1. Galvanized steel pipe for plant and potable water service shall be hot-dipped, zinc coated galvanized, Grade A, electric resistance welded, Schedule 40 conforming to ASTM Designation A120. All joints shall be threaded joints. Threaded joints shall be made up with a stiff mixture of graphite and mineral oil, or an approved, nontoxic, nonhardening, pipe joint compound applied to the male thread only. After having been set up, a joint shall not be backed off unless the joint is completely broken, the threads cleaned and new compound applied. All joints

shall be airtight. A sufficient number of unions shall be provided to allow for convenient removal of piping. Fittings for galvanized steel pipe shall be galvanized malleable iron, 150 psi service rating.

2. Where flanged connections are indicated or otherwise required for connection to flanged valves, fittings, and appurtenances, they shall be made up using companion type flanges. Where flanged fittings are indicated or otherwise required, they shall be made up using thread galvanized steel nipples and steel companion type flanges. Companion flanges shall be steel, 150-psi ANSI Standard flat face flanges of the threaded type. Flanges shall be spot-faced on the back around each bolt hole.
3. All exposed threads, wrench marks, or other damage to the zinc coating, shall be protected by the application of two coats of a heavy consistency, bituminous paint, or with two wraps of an approved vinyl or polyvinyl pressure sensitive tape. Bituminous paint shall be equal to Koppers Bitumastic No. 50, brush applied. Tape shall be equal to 3M Company Scotchrap No. 50, 0.010-inch thick, installed as recommended by 3M Company over a primer.

C. Stainless Steel Pipe:

Stainless steel pipe shall be provided as shown on the drawings. Pipe shall be Schedule 40S, Type 316L, annealed, white pickle finish and shall be in accordance with ASTM Specification A312 and ANSI B36.19. Where indicated on the Drawings, holes shall be drilled in the pipe at the factory by the manufacture.

D. Steel Pipe Sleeves:

Sleeves for pipe that passes through floors and walls shall be galvanized Schedule 40 steel pipe conforming to ASTM Designation A120. Sleeve dimensions shall conform to the details shown on the drawings. Sleeve ends shall be cut and ground smooth. Sleeves shall be flush with walls and ceilings, but shall extend above the floor as shown on the drawings. Sleeves for use with mechanical type seals shall be sized in conformance with the seal manufacturer's requirements.

2.02 STEEL PIPE FOUR (4) INCHES AND LARGER

A. Except as modified or supplemented herein, all steel pipe, fittings and specials shall conform to the applicable requirements of the following standard specifications latest editions:

AWWA Standards

C200 Steel Water Pipe 6 Inches and Larger

C203 Coal-Tar Protecting Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot-Applied.

C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 inches and larger - Shop Applied.

C206 Field Welding of Steel Water Pipe

C207 Steel Pipe Flanges for Waterworks Service - Sizes 4 inches through 144

inches, Class D.

C208 Dimensions for Steel Water Pipe Fittings

B. All steel pipe shall be manufactured and tested in accordance with the standards set forth in AWWA C200 latest edition for fabricated or mill type water pipe. The pipe shall be made from sheet or plate rolled into sections having longitudinal or spirally formed butt-welded seams. Girth seams shall be butt welded and shall be at least 8 feet apart except in specials and fittings. The steel shall conform to the standards established in Section 2 and Section 3 AWWA C200.

1. Minimum Physical Properties of Steel Plate or Sheet:

a. All steel pipe, specials and fittings shall be manufactured from steel plate or sheet having a specified minimum yield of 35,000 psi and specified minimum tensile of 60,000 psi. Test reports verifying the actual physical and chemical properties of the piping must be submitted to the County as soon as possible after manufacturing and fabrication. The test reports shall state the hydrotest pressure applied to all sections of straight pipe and to straight pipe used in fabrication of specials and fittings.

b. All steel pipe, specials and fittings shall be manufactured or fabricated to the diameter as shown on the drawings. The normal size shall be the outside diameter of 14 inches and larger. For sizes less than 14 inches, the pipe shall be the normal steel pipe dimensions as listed in ASTM A53 specification. All diameters of steel pipe, specials and fittings shall have minimum nominal wall thicknesses as stated herein below:

Diameter	Minimum Wall Thickness
54"	.375
48"	.375
42"	.375
36"	.375
30"	.375
24" & smaller	.250

C. All fittings and specials shall be provided with ends as required for installation and shall be fabricated to the dimensions as shown on the drawings. All fittings shall be fabricated in accordance with the standards set forth in AWWA C208 latest edition. Fittings and specials shall be fabricated from hydrostatically tested pipe meeting AWWA C200 and will not require any further hydrostatic test in the shop. In reducing sections, the wall thickness will be governed by the largest end. Elimination of joints shown on the drawings must be approved by the County prior to the fabrication process.

D. Flanged and Coupling Standards:

1. All flanges, bolts, nuts and gaskets shall meet standards established in AWWA C207. Flanges shall be Class D suitable for pressure up to and including 150 psi with facing and drilling as stated in Section 3 of C207. Procedure for attachment of flanges shall be in accordance with Section 10 of AWWA C207. Blind flanges shall conform in diameter drilling and

thickness to the flanges to which they attach and shall produce a watertight joint under the specified test pressure.

2. Mechanical couplings shall be Dresser Style 38, Rockwell Style 411 or equal. The middle ring of each coupling shall have a minimum thickness at least equal to that specified for the size of pipe on which the coupling is to be used and shall be 7 inches long for pipe 30 inches and smaller, 10 inches long for pipe 36 inches and larger. The pipe stop shall be omitted from the inner surface of the middle rings and the couplings shall be cleaned and shop primed with the manufacturer's standard rust inhibitive primer. The filter backwash header and where shown on the drawings shall the mechanically coupled joints be restrained with harness bolts and lugs. Joint harnesses, where applicable, shall conform to the details on the drawings. Lugs shall be attached to the pipe in the shop and coated as specified for the adjacent pipe. The dimensions shall be stated in AWWA M011 19.8.

E. Pipe supports, anchors, blocking and hangers shall be fabricated in accordance with the details shown on the drawings and shall be installed complete with all accessories required for proper operation of the system. Should it be necessary to modify the details for proper installation, all such modifications shall be subject to approval by the County. Lugs required for anchorage of the piping system shall be attached in the shop and coated as the adjacent pipe.

F. All steel pipe, fittings, specials and appurtenances shall be prepared, primed, coated and lined as specified herein below:

1. Exterior surfaces of all steel pipe, fittings, specials, flanges, anchors and pipe supports exposed in above ground or interior locations shall be thoroughly cleaned in the shop by blasting with grit, shot or sand to SSPC SP6. One coat of primer shall be applied to the cleaned dry surface in a proper workmanship like manner and as recommended by the primer manufacturer. The primer shall be subject to approval of the County and compatible to the finish coat as specified in the paid section of the specifications. Field painting of the installed system shall be as specified in the painting section.
2. Interior surfaces of all steel pipe, fittings, and specials, which are to be installed exposed aboveground or in interior locations shall be thoroughly cleaned in the shop by blasting with grit, shot or sand to SSPC SP6. Two coats of paint shall be applied to the interior of the pipe at the shop. The paint coats shall be Koppers Bitumastic Super Tank Solution applied at a minimum of 8 mils D.F.T. per coat.
3. Exterior surfaces of all steel pipe, fittings and specials which are to be installed underground and in manholes which will not be encased in concrete shall be coated in the shop with coal tar enamel in accordance with the standards established in AWWA C203-78, except as modified or supplemented herein.
4. The exterior coating system for below ground steel pipe shall consist of coal tar enamel, fibrous glass mat, asbestos pipelines felt wrap and finally wrapped with Kraft paper and shall be applied by the procedure described in AWWA C203. The coating shall be held back 12 inches from ends to be mechanically coupled with uncoated areas primed with coat tar primer. The coating system must be done in the shop by an established pipe

coating applicator acceptable to the coating materials manufacture and the County. Repairs of the any damage to the coating system incurred during the shipment and the field coating of couplings and ends where coatings have held back for joints shall be done by experienced and qualified personnel approved by the County. Procedure for such field coating shall be as described in AWWA C203.

5. The interior surfaces of all steel pipe, fittings, and specials which are to be installed below ground shall be cleaned and lined with cement mortar conforming to the standards set forth in AWWA C205-80. All work performed in the lining process shall be done in a thorough and workmanship like manner by trained personnel under the supervision of experienced men skilled in the operations they supervise. The lining thickness shall be as follows:

Pipe Size (Inches)	Coating Thickness (Inches)	Tolerance (Inches)
4-10	1/4	-1/32 + 1/32
11-23	5/16	-1/16 + 1/8
24-36	3/8	-1/16 + 1/8
over 36	1/2	-1/16 + 1/8

Handling and transporting of cement mortar lined pipe shall be in accordance with Section 6 of AWWA C205 and Section 2.14 of AWWA C203.

6. The interior surface of all steel air piping shall be coated with a two part epoxy coating system equivalent to 7.0 mils DFT of Mobil Chemical 78-D-7 followed by 7.0 mils DFT of Mobil Chemical 78-W-3 or equal.

2.03 STEEL PIPE AND FITTING AND CHLORINE GAS PIPING

A. If steel pipes are used for chlorine gas lines, they shall be Schedule 80 seamless steel pipe conforming to ASTM A120. All joints shall be threaded. Threaded joints shall be made up with a cement prepared from litharge and glycerin, or Teflon tape. The cement shall be applied to the male thread only. Fitting except unions, shall be carbon steel 2,000 pounds CWP. Unions shall be of the flanged, ammonia type, either two-bolt or four-bolt square.

PART 3 EXECUTION

3.01 INSTALLATION AND TESTING

A. Steel pipe shall be installed true to alignment and rigidly supported anchors shall be provided where indicated.

After installation, the piping shall be tested by undergoing a four-hour pressure test at 20 percent above the designed operating pressure plant water supply lines. If any joint or pipe proves to be defective, it shall be repaired to the satisfaction of the County.

B. Screwed joints shall be made up with good quality thread compound and applied to the male thread only. After having been set up, a joint must not be backed off unless the joint is completely broken, the threads cleaned and new compound applied. All joints shall be

air tight.

C. Stainless steel pipe shall have threaded joints or otherwise as required and shall be installed as shown on the Drawings.

D. Sleeves of the proper size shall be installed for pipes passing through floors and walls as indicated on the drawings. Sleeves shall be given a prime coat of rust inhibitive primer such as Koppers No. 621, or equal.

E. When cutting of pipe is required, the cutting shall be done by machine in a neat workmanlike manner without damage to the pipe. Cut ends shall be smooth and at right angles to the axis of the pipe.

F. All field welding shall be in accordance with the American Welding Society Standards. The strength of the field weld shall develop the strength of the pipe. Welds shall receive a field coating of paint as specified in Section 09900 and as approved by the County.

G. All galvanized steel pipe thread shall be clean, machine cut, and all pipe shall be reamed before erection. Each length of pipe as erected shall be up-ended and rapped to dislodge dirt and scale.

H. All galvanized steel piping shall have a sufficient number of unions to allow convenient removal of piping. Unions shall be compatible with pipe.

3.02 PAINTING

A. Pipe and fittings exposed to view, except stainless steel, shall receive a prime coating of rust inhibitive primer such as Koppers 621 or equal. Prior to prime coating, all surfaces shall be cleaned of all mill scale, rust, dirt, grease and other foreign matter.

B. All piping and fittings exposed to view except stainless steel pipe shall be painted as specified.

END OF SECTION

SECTION 02615 DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install ductile iron pipe and restrained joint ductile iron pipe and cast iron or ductile iron restrained joint fittings, complete, as shown on the Drawings and specified in these Standards.

B. Fittings are noted on the drawings for the Contractor's convenience and do not relieve him from laying and jointing different or additional items where required.

C. The Contractor shall furnish all labor, materials, equipment and incidentals required to install push-on joint or restrained joint ductile iron pipe, complete as shown on the Drawings and Specifications.

D. Newly installed pipe shall be kept clean and free of all foreign matter. All DI pipe installed underground shall be poly wrapped unless noted otherwise on the plans.

1.02 SUBMITTALS

A. The Contractor shall submit to the County, within ten days after receipt of Notice to Proceed, a list of materials to be furnished, the names of the suppliers and the appropriate shop drawings for all ductile iron pipe and fittings.

B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51. Thickness of pipe shall be Class 50 or pressure Class 350. All pipe not buried shall be Class 53. All ductile iron pipe shall be clearly marked on the outside of the barrel to readily identify it from cast iron.

B. Unrestrained joint pipe shall be supplied in lengths not to exceed 21 feet. Unless otherwise called for in the Contract Documents, 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, or approved equal.

C. All fittings shall be pressure rated for 350 psi and meet the requirement of AWWA C110 or AWWA C153 except flanged fittings shall be rated for 250 psi. Rubber gaskets shall conform to ANSI A21.11 for mechanical and push-on type joints for diameters up to 14" diameter. Gaskets for 16" diameter and larger pipe shall be EPDM (Ethylene-Propylene Dine Monomer) such as the "Fastite Gasket" of American Ductile Iron Pipe Co., or approved equal.

D. Water Mains: All ductile iron pipe and fittings shall have a standard thickness cement lining on the inside in accordance with AWWA/ANSI C104/A21.4 and a coal tar enamel coating on the outside. The coal tar enamel shall be in accordance with ANSI A21.4. All interior linings shall be EPA/NSF approved.

E. Force Main: All ductile iron pipe and fittings shall have a factory applied fusion bonded epoxy or epoxy and polyethylene lining on the inside in accordance with manufacturer's specifications and a coal tar enamel coating on the outside. The coal tar enamel shall be in accordance with ANSI A21.4. The interior lining is to be based on manufacturer's recommendation for long-term exposure to raw sewage. It shall have a minimum ten year warranty covering failure of the lining and bond failure between liner and pipe.

F. Restrained joints shall be provided at all horizontal and vertical bends and fittings, at casings under roads and railroads and at other locations shown on the Contract Drawings. Restrained joint pipe fittings shall be designed and rated for the following pressures: 350 psi for pipe sizes up to and including 24" diameter; 250 psi for pipe sizes 30" diameter and above.

2.02 IDENTIFICATION

A. Each length of pipe and each fitting shall be marked with the name of the manufacturer, size and class and shall be clearly identified as ductile iron pipe. All gaskets shall be marked with the name of the manufacturer, size and proper insertion direction.

B. Pipe shall be poly wrapped blue for potable water mains, purple for reclaimed water mains and green for sewage force mains. All potable water pipe shall be NSF certified and copies of lab certification shall be submitted to the County.

C. All above ground potable water mains and appurtenances shall be painted safety blue.

D. Above ground sewage force mains shall be painted green. Above ground reclaimed water mains shall be painted purple. All other above ground pipe shall be color coded to match existing pipes of like use, or as directed by the County.

END OF SECTION

SECTION 02617 INSTALLATION AND TESTING OF PRESSURE PIPE

PART 1 GENERAL

1.01 INSTALLING PIPE AND FITTINGS

A. The Contractor shall install all pipe in accordance with the recommendations of the pipe manufacturer and as specified herein.

B. The Contractor shall take care in handling, storage and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installation and pipe which is deemed to be defective by the County shall not be installed.

C. The Contractor shall thoroughly clean and keep thoroughly clean, all pipe and fittings prior to during and after installation.

D. The Contractor shall lay the pipe to the lines and grades shown on the Contract Drawings with bedding and backfill as shown on the Drawings or called out in the Contract Documents. Blocking under the pipe shall not be permitted except through casing sleeves.

E. The Contractor shall keep the open ends of all pipe closed with a tightly fitting plug when installation is not in progress or the potential exists for dirt or debris to enter the pipe.

F. The pipe or accessories shall not be dropped into the trench under any circumstances.

G. The Contractor shall construct all water mains pursuant to the provisions of "Recommended Standards for Water Works", Part 8, incorporated by reference in Rule 17-555.330(3), F.A.C.

H. As a marker for the Surveyor, a PVC pipe marker or 2” x 4” marker shall be inserted by the Contractor on the top of pipe for potable water mains, reclaimed water mains and sanitary force mains at intervals no greater than 200 feet apart and at locations where there is a substantial grade change. The pipe markers shall indicate the pipe diameter and shall be labeled PWM in “safety” blue, RWM in purple, and FM in green, for potable water mains, reclaimed water mains and sanitary force mains, respectively. As a marker for the Surveyor, a PVC pipe marker or 2” x 4” marker shall be inserted by the Contractor on the top of all pipe fittings (other than sanitary sewer service wyes, potable water saddles and reclaimed water saddles). The markers for fittings shall indicate the type of fitting and shall be labeled PWF in “safety” blue, RWF in purple, and FMF in green, for potable water fittings, reclaimed water fittings, and sanitary force main fittings, respectively. The Contractor is responsible for making the aforementioned markers available to the Surveyor. The Contractor shall field locate the mains and fittings when markers are not made available to the Surveyor.

I. A PVC pipe marker or 2” x 4” marker shall be inserted by the Contractor at the beginning and end of each horizontal directional drill (HDD). The HDD Contractor shall provide a certified report and bore log indicating the horizontal and vertical location every 25 linear feet or less along the pipe.

J. A 2” PVC pipe marker with a painted end cap shall be inserted by the Contractor at the

ROW line indicating each individual new service location or stub out. The marker shall be a 6 foot length of PVC pipe inserted 2 feet into the ground and shall be painted “safety” blue for potable water, purple for reclaimed water, and green for sewer.

1.02 PROCEDURE FOR TESTING WATER LINES, FORCE MAINS AND RECLAIMED WATER LINES

A. A 48-hour notice is needed prior to testing. A letter stating the reasons testing should be scheduled ahead of other jobs must accompany all emergency testing requests.

B. County and Contractor must be present for all testing, except for testing tapping valves and sleeves.

C. All pressure pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). Maximum length of pipe to be tested at one time is 2,600 feet. If line is longer than 2,600 feet and cannot be sectioned in 2,600 feet (max.) lengths, the allowable leakage will be figured at 2,600 feet.

D. Allowable leakage shall be determined by AWWA C600 table for hydrostatic tests. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof; to maintain the test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

E. All digging on the job site in the right-of-way must be completed before any testing of water or sewer. Any digging or boring across water or sewer lines after they have been tested may result in a retest of the lines at the County's request.

F. If any revisions or changes are made after initial testing, lines will be re-tested at the County's request.

G. Disconnect water supply during test.

H. All force mains will be tested from the valves in the valve vault at the lift station to the point of connection whether it be against a valve on another force main or into a manhole.

I. All services to be aboveground during test. The services should be the correct length so they will be one (1) foot inside right-of-way line.

J. All fire hydrant gate valves to be open during test.

K. All visible leaks are to be repaired, regardless of the amount of leakage.

L. Check gauge pressure periodically during test. If test pressure drops to 175 psi for water/reclaimed lines or to 145 psi for force mains during test, the line must be repumped back to 180 psi for water/reclaimed (150 psi force mains) and the amount of leakage measured. The test will continue on with the remaining time left. At the end of the test, the line must be repumped again back to 180 psi (150 psi for force main) and the amount of leakage measured and added to any previous leakage determined earlier in the test.

M. After the line passes the test, the pressure will be blown off from the opposite end of line

from the gauge location. Fire hydrants, services and end-of-line blow offs will be opened to demonstrate they were on line during the test.

N. At end of test, the test gauge must return to zero. The pressure gauge must read 0 psi to a maximum of 300 psi in 5 psi increments.

O. The section of line being tested must be identified on the charge sheet. The length and size of pipe, the exact area being tested and the valves being tested against, must be identified. Use Station numbers if available.

P. A punch list must be made at the end of all tests.

Q. A copy of the charge sheet will be given to the County and the Contractor at the end of the test.

1.03 INSPECTION/TESTING PROCEDURE COVERING BORED PIPE LINES OR CASING AND CONDUITS INSTALLED ACROSS PREVIOUSLY TESTED AND/OR COUNTY ACCEPTED WATER AND SEWER PIPE WITHIN DEVELOPMENT PROJECTS UNDER ACTIVE CONSTRUCTION

A. Prior to testing water and sewer lines, every effort will be made to install sleeves for underground utilities that will cross these water and sewer lines or services.

B. Where it has not been possible to pre-install sleeves prior to testing and bores or conduits are required, it is the responsibility of the utility company and/or their Contractor performing the work to provide Manatee County Utility Operations Department or the Engineer of Record with accurate horizontal and vertical as-built information of the sleeves, bores and conduits installed by said utility company. This applies to all bores and conduits crossing water and sewer lines.

C. Procedures to be followed for installation of conduits, pipe lines and bores that will cross, or be closer than 5'-0" horizontally and 18 inches vertically to, previously tested water and sewer lines that are still under the ownership of the developer/contractor.

1. Notify the County and obtain the best as-built information available. Allow sufficient time for the County to field locate the existing pipe lines.
2. Submit drawings of proposed location to the County and Manatee County Utility Operations Dept. Utility Locations Section for review.
3. Obtain a County Right-of-Way Use Permit if the work area is within a dedicated area of right-of-way.
4. Perform installation in the presence of a County representative. Call (941) 792-8811, ext. 5061 or ext. 5069 with at least two (2) working days' notice.
5. Submit two (2) copies of as-built information to the County to incorporate into the record drawings to be submitted to the County.
6. Failure to follow steps 2) thru 5) will result in additional charges for retesting the previously tested water and sewer lines.

D. Procedures to be followed for installation of conduits, pipe lines and bores crossing or closer than 5'-0" horizontally and 18 inches vertically to previously tested water and sewer lines that have been previously accepted by Manatee County:

1. Obtain record drawing information from the County.

2. If roadway has been dedicated to Manatee County, obtain Right-of-Way Use Permit and copy the Project Management Department Locations Section with proposed location drawing.
3. Follow procedures in "Sunshine State One-Call", paying special attention to the requirements of Section VII.

E. Should water or sewer lines be damaged during the bore pipe line or casing installation, the cost of any repairs and retesting will be paid for by the utility company that installed the bore. The actual clearance between a bored casing crossing a water or sewer pipe should not be less than 18 inches.

1.04 DETECTION

A. Direct buried pipe shall have 3" detectable metallic tape of the proper color placed directly above the pipe and 12" below finished grade or 6" detectable tape between 12" and 24" below finished grade.

B. Direct buried or horizontal directional drilled non-metallic pipe shall also have tracer wire installed along the pipe alignment. The tracer wire to be used shall be a solid, 10 gauge, high strength, copper clad steel wire with a polyethylene jacket of appropriate color manufactured by Copperhead Industries or Manatee County approved equal.

END OF SECTION

SECTION 02620 POLYETHYLENE (PE) PRESSURE PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install polyethylene pressure pipe, fittings and appurtenances as shown on the Drawings and specified in the Contract Documents and these Standards.

B. Newly installed pipe shall be kept clean and free of all foreign matter & gouges.

C. All pipe shall be correctly color coded / identified.

1.02 QUALIFICATIONS

All polyethylene pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the items to be furnished.

1.03 SUBMITTALS

A. The Contractor shall submit to the County, within ten days after receipt of Notice to Proceed, a list of materials to be furnished, the names of the suppliers and the appropriate shop drawings for all polyethylene pipe and fittings.

B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

C. The Contractor shall submit shop drawings showing installation method and the proposed method and specialized equipment to be used.

PART 2 PRODUCTS

2.01 POLYETHYLENE PRESSURE PIPE

A. Polyethylene pipe 4" diameter and larger shall be high-density PE 3408 polyethylene resin per ASTM D 3350, Cell Classification 345464C, Class 160, DR 11, CPChem DriscoPlex 4000, 4300 or 4500 or an approved equal, meeting the requirements of AWWA C906. All pipe materials used in potable water systems shall comply with NSF Standard 61. Outside diameters of water, reclaimed water and pressure sewer HDPE pipes shall be ductile iron size (DIPS).

B. Polyethylene pipe and tubing 3" diameter and smaller shall be pressure Class 200, DR 9 "Driscopipe 5100", Endo Pure by Endot, or equal, meeting the requirements of AWWA C901 (latest revision) and the following ASTM requirements:

Material Designation PPI/ASTM PE 3408
Material Classification ASTM D-1248 III C5 P34
Cell Classification ASTM D-3350

2.02 JOINTS

A. Where PE pipe is joined to PE pipe, it shall be by thermal butt fusion. Thermal fusion shall be accomplished in accordance with the written instructions of the pipe manufacturer and fusion equipment supplier. The installer of the thermal butt fused PE pipe shall have received training in heat fusion pipe joining methods and shall have had experience in performing this type of work.

B. Where thermal butt fusion cannot be used, or when specifically called for on the plans, electro-fused couplings may be used. Fusion shall be in accordance with the written instructions of the fitting manufacturer.

C. Flanged joints, mechanical joints, tapping saddles, and molded fittings shall be in accordance with AWWA C901, C906 or C909, ASTM D3350 and D3140, as applicable. Fusion and mechanical connections are allowed, chemical (solvents, epoxies, etc.) are not allowed.

2.03 DETECTION

A. Direct buried HDPE pipe shall have 3" detectable metallic tape of the proper color placed directly above the pipe and 12" below finished grade or 6" detectable tape between 12" and 24" below finished grade.

B. Direct buried or horizontal directional drilled HDPE pipe shall also have tracer wire installed along the pipe alignment. The tracer wire to be used shall be a solid, 10 gauge, high strength, copper clad steel wire with a polyethylene jacket of appropriate color manufactured by Copperhead Industries or Manatee County approved equal.

2.04 IDENTIFICATION

A. Pipe shall bear identification markings in accordance with AWWA C906.

B. Pipe shall be color coded blue for water, purple (Pantone 522 C) for reclaimed water or green for pressure sewer using a solid pipe color or embedded colored stripes. Where stripes are used, there shall be a minimum of three stripes equally spaced.

PART 3 EXECUTION

3.01 INSTALLING POLYETHYLENE PRESSURE PIPE AND FITTINGS

All polyethylene pressure pipe shall be installed by direct bury, directional bore, or a method approved by the County prior to construction. If directional bore is used, or if directed by the County, the entire area of construction shall be surrounded by silt barriers during construction.

3.02 INSPECTION AND TESTING

All pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure and leak test per section 02617.

END OF SECTION

SECTION 02622 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS (AWWA SPECIFICATIONS C-900 & C-905)

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment and incidentals required to install the plastic piping, fittings and appurtenances complete and ready for use as specified in the Contract Documents and these Standards.

1.02 DESCRIPTION OF SYSTEM

The Contractor shall install the piping in the locations as shown on the Drawings.

1.03 QUALIFICATIONS

All plastic pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, qualified and specializes in the manufacture of the items 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.

1.04 SUBMITTALS

A. The Contractor shall submit shop drawings to the County including, but not limited to, dimensions and technical specifications for all piping.

B. The Contractor shall submit to the County, samples of all materials specified herein.

C. The Contractor shall submit and shall comply with pipe manufacturer's recommendation for handling, storing and installing pipe and fittings.

D. The Contractor shall submit pipe manufacturer's certification of compliance with these Specifications.

1.05 TOOLS

The Contractor shall supply special tools, solvents, lubricants, and caulking compounds required for proper installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pressure Class-Rated Polyvinyl Chloride (PVC) Pipe

1. Pressure class-rated PVC pipe and accessories four to twelve inches (4"-12") in diameter, shall meet the requirements of AWWA Specification C-900 "Polyvinyl Chloride (PVC) Pressure Pipe". Pipe shall be Class 150, meeting requirements of Dimension Ratio (DR) 18 and shall have the dimension of ductile iron outside

diameters. Each length of pipe shall be hydrotested to four (4) times its class pressure by the manufacturer in accordance with AWWA C-900.

2. PVC pipe 14" through 36" shall meet the requirements of AWWA Standard C-905, Polyvinyl Chloride (PVC) Water Transmission Pipe. Pipe 14" thru 24" for potable and reclaim water shall meet the requirements for dimension ratio (DR) 18. Each length of pipe shall be tested at twice the pressure rating (PR 235 psi) for a minimum dwell of 5 seconds in accordance with AWWA C-905. Fourteen inch (14") thru 36" PVC pipe for sewer force mains shall meet AWWA C-905 requirements for dimension ratio (DR) 21. Each length of pipe shall be tested at twice the pressure rating (PR 200 psi) for a minimum dwell of five seconds in accordance with AWWA C-905.

   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 as recommended by the manufacturer. Pipe shall be furnished in nominal lengths of approximately 20 feet, unless otherwise directed by the County. Pipe and accessories shall bear the NSF mark indicating pipe size, manufacturer's names, AWWA and/or ASTM Specification number, working pressure, and production code.

3. Gaskets for 16" diameter and larger pipe used for potable water pipe shall be EPDM (Ethylene-Propylene Dine Monomer).

4. PVC pipe 3" and less in diameter may be constructed using pipe conforming to ASTM D2241 with push-on joints. Pipe shall be 200 psi pipe-SDR 21 unless otherwise specified by the County. This PVC pipe shall not be used for working pressures greater than 125 psi.

5. Pipe shall be blue for potable water mains, green for sewage force mains and purple for reclaimed water mains. All potable water pipe shall be NSF certified and copies of lab certification shall be submitted to the County.
6. Where colored pipe is unavailable, white PVC color coded spiral wrapped pipe shall be installed.

B. Joints

1. The PVC joints for pipe shall be of the push-on type unless otherwise directed by the County 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 resilient gasket joint designed to be assembled by the positioning of a continuous, molded resilient ring gasket in an 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 resilient ring joint shall be designed for thermal expansion or contraction with a total temperature change of at least 75 degrees 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 F-477. 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. Gaskets shall be suitable for use with potable water, reclaimed water or sanitary sewer as applicable.

2. Restrained joints shall be provided at all horizontal and vertical bends and fittings, at casings under roads and railroads and at other locations shown on the Contract Drawings. PVC joints for pipe shall be restrained by the following methods: thrust blocks, restraining glands such as Certa-Lok Restraining Joint Municipal Water Pipe by the Certain Teed Corporation of Valley Forge, PA, or approved equal. All Grip, Star Grip by Star Products, MJR by Tyler Pipe, Tyler, Texas. Restrained joint PVC pipe shall be installed in strict accordance with the manufacturer's recommendation.

C. Fittings

1. All fittings for class-rated PVC pipe shall be ductile iron with mechanical joints and shall conform to the specifications for ductile iron fittings, unless otherwise directed. Class 200, C-900 PVC fittings are allowable for sewage force main applications up to and including 12" diameter only. DR ratio shall be the same as the pipe.

2. The manufacturer of the pipe shall supply all polyvinyl chloride accessories as well as any adapters 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.

PART 3 EXECUTION

3.01 INSTALLATION

The Contractor shall install the plastic pipe in strict accordance with the manufacturer's technical data and printed instructions. Direct bury pipe shall have 3" detectable metallic tape of the proper color placed directly above the pipe 12" below finished grade or 6" detectable tape between 12" and 24" below grade.

3.02 INSPECTION AND TESTING

All pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). All visible leaks shall be repaired and retested for approval by the County. Prior to testing, the pipe lines shall be supported in a manner approved by the County to prevent movement during tests.

END OF SECTION

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SECTION 02623 POLYVINYL CHLORIDE (PVC) PIPE (GRAVITY SEWER)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, equipment, materials, pipe and incidentals and shall construct gravity sewers, complete, as shown on the drawings and as herein specified.

B. The work shall include furnishing, laying and testing gravity sewer pipe.

1.02 SUBMITTALS DURING CONSTRUCTION

A. The Contractor shall submit prior to construction, Shop Drawings, Working Drawings and Samples for approval to the County.

B. The Contractor shall submit to the County not less than fourteen (14) calendar days after the date of the Notice to Proceed, a list of materials to be furnished, the names of suppliers and an expected schedule of delivery of materials to the site.

C. The Contractor shall furnish in duplicate to the County sworn certificates that all tests and inspections required by the Specifications under which the pipe is manufactured have been satisfied.

D. The pipe manufacturer shall inspect all pipe joints for out-of-roundness and pipe ends for squareness. The Contractor shall furnish to the County, a manufacturer's Notarized Affidavit stating all pipe meets the requirements of ASTM, ASCE, ANSI, the Contract Documents, as well as all applicable standards regarding the joint design with respect to square ends and out-of-round joint surfaces.

1.03 INSPECTION AND TESTS

A. All pipe and accessories installed under this Contract shall be inspected and tested as required by the Standard Specifications to which the material is manufactured. The pipe shall be tested at the place of manufacture or taken to an independent laboratory by the manufacturer.

B. Each length of pipe shall be subject to inspection and approval at the factory, point of delivery and site of work. Sample of pipe to be tested shall be selected at random by the County or the testing laboratory and shall be delivered by the Contractor to the testing laboratory approved by the County.

C. When the specimens tested conform to applicable standards, all pipe represented by such specimens shall be considered acceptable based on the test parameters measured. Copies of test reports shall be submitted to the County prior to the pipe installation. Acceptable pipe shall be stamped with an appropriate monogram under the supervision of the testing laboratory.

D. All pipe test specimens failing to meet the applicable standards shall be rejected. The Contractor may provide two additional test specimens from the same shipment or delivery

for each failed specimen. The pipe shall be acceptable if both of these additional specimens meet the requirements of the applicable standards.

E. Pipe which has been deemed unacceptable by the County shall be removed from the work site by the Contractor and shall be replaced with acceptable pipe.

PART 2 MATERIALS

2.01 GENERAL

A. The sizes of gravity sewer pipe shall be shown on the Drawings.

B. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel.

2.02 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

A. PVC pipe, sizes 6" through 12", for use in non-pressure gravity sewer mains and laterals shall have an SDR of 26 and conform to ASTM D-3034. PVC pipe shall be made of PVC plastic, homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be uniform in color, density and other physical properties.

B. PVC pipe sizes over 12" shall be approved by Manatee County.

C. All pipe shall be in compliance with the above standard and be clearly marked as follows at intervals of 5 feet or less:

1. Manufacturer's name or trademark.
2. Nominal pipe size.
3. PVC cell classification (eg. 12454-B).
4. The legend "Type PSM SDR-26 PVC Sewer Pipe" and the designation ASTM D-3034.

D In addition to the above mentioned requirements, all PVC sanitary sewer pipe shall be color coded green to conform with Manatee County Standards.

E. PVC sewer fittings shall conform to the requirements of ASTM D-3034 and shall have an SDR of 26. Six inch PVC fittings for sewer laterals shall be SDR 26. Fittings shall be molded in one piece with elastomeric joints and minimum socket depths as measured in accordance with ASTM D-3034. Fittings not currently available in molded form may be fabricated in accordance with ASTM D-3034 with manufacturer's standard pipe bells and gaskets. Gasket shall have a minimum cross sectional area of 0.20 sq. in. and conform to ASTM F-477 specification.

2.03 JOINTING PVC PIPE

A. The PVC joints shall be of the push-on type 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 conforming to ASTM F-477, designed to be assembled by the positioning of a continuous molded rubber ring gasket in an annular

recess in the pipe of 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 degrees 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 F-477. 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, and shall have no deteriorating effects on the gasket or pipe material.

B. Wyes and riser fittings shall be gasketed connections. If female adapters SDR 26 or 35 are unavailable, solvent welds shall be acceptable upon approval by the County.

C. Rubber doughnuts are not to be used.

2.04 JOINTS FOR DISSIMILAR PIPE

Joints between pipe of different materials shall be made using mechanical joint connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings, nor shall plastic piping be threaded into metal valves, fittings, or couplings.

2.05 PIPE BEDDING AND PIPE COVER MATERIALS

A. Pipe bedding and cover material shall be as specified in the Contract Documents.

B. Pipe bedding and cover material for polyethylene coated ductile iron pipe fittings shall be well graded sand.

PART 3 EXECUTION

3.01 PIPE DISTRIBUTION

The Contractor shall not distribute material on the job faster than it can be used to good advantage. He shall unload pipe which cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. He shall not drop pipe of any size from the bed of the truck to the ground. He shall not distribute more than one weeks supply of material in advance of laying, unless otherwise approved by the County.

3.02 PIPE PREPARATION AND HANDLING

A. The Contractor shall inspect all pipe and fittings prior to lowering them into trench. Cracked, broken, or otherwise defective materials are not acceptable and shall not be used. The Contractor shall clean the ends of the pipe thoroughly. He shall remove foreign matter and dirt from inside of pipe and keep the pipe clean during and after laying.

B. The Contractor shall use proper implements, tools and facilities for the safe and proper protection of the work. He shall lower the pipe into the trench in a manner to avoid any physical damage to the pipe, remove all damaged pipe from the job site and under no circumstances shall the pipe be dropped or dumped into trenches.

3.03 LINE AND GRADE

A. The Contractor shall not deviate more than 1/2-inch for line and 1/4-inch for grade from the line design and design grade established by the County provided that such variation does not result in a level or a reverse sloping invert. He shall measure the grade at the pipe invert and not at the top of the pipe. The Contractor shall furnish, set and control the line and grade by laser beam method. Other methods of controlling line and grade may be submitted to the County for approval if using the laser beam method proves to be impractical because of other conditions.

B. The Contractor shall use the laser beam method of maintaining line and grade. The Contractor shall submit evidence to the County that a qualified operator shall handle the equipment during the course of construction. A "Caution-Laser Light" placard shall be displayed in a conspicuous place. When "in the pipe" method is used, grade boards shall be installed for the first 50 feet of pipe. The Contractor shall check the line and grade at any additional points at which offset stakes have been placed and when requested by the County. A fan shall be provided to circulate the air if bending of the beam due to air temperature variations becomes apparent with "in the pipe" units. However excessive air velocity shall not be permitted to cause pulsating or vibrating of the beam. If, in the opinion of the County, the beam cannot be accurately controlled, this method of setting line and grade shall be discontinued. When the above ground method is used, the set-up shall be checked with the three grade boards including one set at the upstream manhole. If the laser has a gradient indicator, two boards may be used to check the set-up. The grade board at the up-stream manhole shall be retained to check into as pipe laying progresses.

3.04 PREPARATION OF TRENCH

A. The Contractor shall provide pipe bedding material under all the pipe for the full trench width. The minimum depth of bedding material below the pipe barrel shall be as follows

Pipe Size	Minimum Depth of Bedding Under Pipe Barrel
15" & Smaller	4 inches
18" to 36"	6 inches
42" & Large	9 inches

B. The depth of pipe bedding material under the pipe bell shall not be less than three inches under normal trench conditions.

C. The Contractor shall hand-grade bedding to proper grade ahead of the pipe laying operation. The bedding shall provide a firm, unyielding support along the entire pipe length.

D. Should the Contractor excavate the trench below the required depth for pipe bedding material placement without direction from the County, the Contractor shall fill the excess depth with pipe bedding material as specified herein to the proper subgrade.

E. The Contractor shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

3.05 DEWATERING

The Contractor shall prevent water from entering the trench during excavation and pipe laying operations to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.

3.06 LAYING AND JOINTING PIPE AND FITTINGS

A. The Contractor shall lay pipe upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, he shall clean the end of the pipe to be joined, the inside of the joint and, if applicable, the rubber ring immediately prior to joining the pipe. The Contractor shall assemble the joint in accordance with the recommendations of the manufacturer of the type of joint used. He shall provide all special tools and appliances required for the jointing assembly.

B. The Contractor shall lay all pipe uniformly to line and grade so that the finished sewer shall present a uniform bore. Variations from line and grade in excess of the tolerances specified under LINE AND GRADE are not acceptable and the work shall be rejected.

C. The Contractor shall check the pipe for alignment and grade after the joint has been made. The pipe bedding shall form a continuous and uniform bearing and support for the pipe barrel between joints. Sufficient pressure shall be applied to the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. The Contractor shall place sufficient pipe cover material to secure the pipe from movement prior to installing the next joint to assure proper pipe alignment and joint makeup.

D. Pipe 21" and smaller intended to be in straight alignment shall be laid so that the inside joint space does not exceed 3/8" in width. If interior joints on 24" and larger pipe laid either in straight alignment or on a curve are greater than 3/8", the Contractor shall thoroughly clean the joint surfaces and fill and seal the entire joint with premixed mortar conforming to ASTM C-387 only after the trench has been backfilled, unless otherwise approved by the County. Trowel smooth on the inside surface. Water shall not be allowed to rise in or around, or pass over any joint before it has substantially set.

E. When the Contractor lays pipe within a movable trench shield, he shall take all necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.

F. The Contractor shall prevent excavated or other foreign material from getting into the pipe during the laying operation. He shall close and lock the open end of the last laid section of pipe to prevent entry of foreign material or creep of the gasketed joints when laying operations cease, at the close of the day's work, or whenever the workers are absent from the job.

G. The Contractor shall plug or close off the pipes which are stubbed off with temporary plugs.

H. The Contractor shall take all necessary precautions to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.

I. The Contractor shall make connections of non-reinforced pipe to manholes or concrete structures, so that a standard pipe joint is located at a minimum of 18" outside the edge of structure.

J. When field cutting and/or machining the pipe is necessary, the Contractor shall use only tools and methods recommended by the pipe manufacturer and approved by the County.

K. Service lateral shall be constructed by the Contractor as shown on the standard sewer details and located approximately as shown on the Contract Drawings.

3.07 LAYING PLASTIC PIPE

A. Polyvinyl chloride (PVC) pipe shall be installed by the Contractor in accordance with the instructions of the manufacturer, as shown on the Drawings and as called out in the Contract Documents.

B. The Contractor shall lay the pipe, bedding and backfill to lines and grade shown on the Drawings and called out in the Contract Documents. Blocking under the pipe will not be permitted.

C. The Contractor shall install a green metallic tape as shown in these Standards below finish grade along the entire pipeline PVC sewer main pipe route.

D. The Contractor shall use care in the handling, storage and installation of pipe. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation.

3.08 BACKFILL IN THE PIPE ZONE

A. The pipe zone shall be considered to include the full width of the excavated trench from the bottom of the trench to a point above the top outside surface of the barrel of the pipe.

B. The Contractor shall pay particular attention to the area of the pipe zone from the flow line to the springline of the pipe to insure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

C. The Contractor shall take care to insure that the pipe does not rest directly on the bell or pipe joint, but is uniformly supported on the barrel throughout its entire length.

D. After the pipe is laid by the Contractor to line and grade, he shall place and carefully compact pipe bedding material for the full width of the trench to the springline of the pipe. He shall place the material around the pipe in 6-inch layers and thoroughly hand tamp with approved tamping sticks supplemented by "walking in" and slicing with a shovel to assure that all voids are filled.

E. The Contractor shall backfill and carefully compact the area above the pipe springline with pipe cover material to a point 12" above the top outside surface of the pipe barrel. Pipe bedding material may, at the Contractor's option, be substituted for pipe cover material.

3.09 EXCESS TRENCH WIDTH

A. Normal trench widths shall be as shown on the Drawings. If the normal trench width below the top of the pipe is exceeded for any reason, the Contractor shall furnish an adequate support for the pipe. The County may determine that the pipe being used is strong

enough for the actual trench width or the Contractor may furnish a stronger pipe or a concrete cradle for approval.

B. Concrete thickness under the pipe shall be one-third of the nominal diameter of the pipe, but not less than four inches. Concrete block or brick may be used for adjusting and maintaining proper grade and elevation of pipe. After the pipe is laid to line and grade, the Contractor shall place 3,000 psi concrete under the pipe for the full width of the trench to form a cradle of the required length and thickness with the concrete brought up to a level equal to 1/4 of the inside pipe diameter below the springline of the pipe. Start and terminate the concrete cradle at the face of a pipe bell or collar. Do not encase pipe joints at the ends of the concrete cradle.

C. After the concrete has taken initial set, the Contractor shall place cover material over the concrete cradle and up to a level 12" above the pipe barrel and for the full width of the trench. Cover material shall be placed by hand or by equally careful means.

3.10 CONNECTING DISSIMILAR PIPE MATERIALS

The Contractor shall use the following method to connect dissimilar pipe materials. Use concrete closure collars only when approved by the County and then only to make connections between dissimilar pipe when standard rubber gasketed joints or flexible couplings are impracticable. Before the closure collars are poured, wash the pipe to remove all loose material and soil from the surface on which the concrete will be placed. Wet nonmetallic pipe thoroughly prior to pouring the collars. Wrap and securely fasten a light gauge of sheet metal or building-felt around the pipe to insure that no concrete shall enter the line. Place reinforcement as shown on the plans. Make entire collar in one pour using 3,000 psi concrete and extend a minimum 12" on each side of the joint. The minimum thickness around the outside diameter of the pipe shall be 6". No collar shall be poured in water. After the collars are poured and have taken their initial set, cure by covering with well-moistened earth.

3.11 PIPE BULKHEADS

A. Connections for future sewers shall be bulkheaded by the Contractor in the following manner:

1. All wyes and bell-and-spigot pipe sewers 18" in diameter or smaller shall be bulkheaded with caps or disc stoppers with factory-fabricated resilient joints. The disk or cap shall be banded or otherwise secured to withstand all test pressures without leakage.
2. Connections 21" and 24" in diameter shall be bulkheaded with a four-inch brick wall, using clay brick or concrete brick. The wall shall be capable of withstanding all test pressures without leakage.
3. Connections 27" in diameter and larger shall be bulkheaded with an eight-inch wall, using clay brick or concrete brick. The wall shall be capable of withstanding all test pressures without leakage.

3.12 AIR TEST FOR GRAVITY SEWERS - GENERAL

A. Gravity sewers shall be required to pass the low pressure air test described herein.

B. Air loss rates may be measured by the County. These tests shall be performed by the

Contractor under the observation of the County Inspector.

C. The groundwater height above the installed pipe shall be determined by attaching a transparent plastic tube to a pipe nipple in the manhole and using the plastic tube as a manometer. A test hole may be dug directly above the sewer main for visual inspection.

D. The ends of branches, laterals, tees, wyes and stubs included in a test section shall be plugged to prevent air leakage. All plugs shall be secured to prevent blowout due to internal pressure. A test section is defined as the length of sewer between manholes.

E. The Contractor shall repair all visible leaks in manholes and pipe, even if the leakage test requirements are met.

3.13 LAMP TEST FOR GRAVITY SEWER MAINS

A. Prior to testing, the Contractor shall prepare the lines for testing. All lines shall be thoroughly cleaned.

B. The Contractor shall furnish all equipment necessary for testing including, but not limited to, ladders, a lamping light and a vehicle to use as power source.

C. Gravity lines shall be lamped from both the upstream and downstream ends between the manholes.

D. A minimum image of 75% shall be acceptable.

E. Failure to meet the 75% image requirement shall result in the Contractor having to video tape the line at his own expense. The County or his representative shall be present while the line is video taped. The tape shall be submitted to Manatee County for evaluation.

F. The Contractor shall relay or otherwise correct any line deemed unacceptable by the County. This work shall be done entirely at the Contractor's expense.

G. Grouting of sewer lines or re-rounding machines are not approved corrective measures.

H. Sewer lines shall be re-lamped and may be required by Manatee County to be video taped again.

3.14 FINAL SEWER CLEANING

A. Prior to final acceptance and final manhole-to-manhole inspection of the sewer system by the County, the Contractor shall flush and clean all parts of the system, remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the sewer system at or near the closest downstream manhole.

B. During the final manhole-to-manhole inspection of the sewer system, the County may require the Contractor to reflush and clean any section or portion of the line if any foreign matter is still present in the system.

END OF SECTION

SECTION 02640 VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All valves and appurtenances shall be of the size shown on the Drawings and, to the extent possible, all equipment of the same type on the Project shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. All valves shall have a factory applied, fusion bonded epoxy coating on interior and exterior unless noted otherwise in the plans or this specification.

E. The equipment shall include, but not be limited to, the following:

1. Gate valves (Sec. 2.01)
2. Pressure Sustaining and Check Valves (Sec. 2.02)
3. Ball Valves for PVC Pipe (Sec. 2.03)
4. Butterfly Valves (Sec. 2.04)
5. Plug Valves (Sec. 2.05)
6. Valve Actuators (Sec. 2.06)
7. Air Release Valves (Sec. 2.07)
8. Valves Boxes (Sec. 2.08)
9. Corporation Cocks (Sec. 2.09)
10. Flange Adapter Couplings (Sec. 2.10)
11. Flexible Couplings (Sec. 2.11)
12. Hose Bibs (Sec. 2.12)
13. Slow Closing Air and Vacuum Valves (Sec. 2.13)
14. Surge Anticipator Valve (Sec. 2.14)
15. Check Valves (Sec. 2.15)
16. Hydrants (Sec. 2.16)
17. Restraining Clamps (Sec. 2.17)
18. Tapping Sleeves and Tapping Valves (Sec. 2.18)
19. Single Acting Altitude Valves (Sec. 2.19)

1.02 DESCRIPTION OF SYSTEMS

All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaim water, wastewater, etc., depending on the applications.

1.03 QUALIFICATIONS

All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable. Valves shall be as covered under mechanical devices in Section 8 of ANSI/NSF Standard 61.

1.04 SUBMITTALS

A. Submit to the County within 30 days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. Complete shop drawings of all valves and appurtenances shall be submitted to the County for approval in accordance with the Specifications.

C. Submit detail product data for valve actuators, including motor data, control switches and interconnection wiring diagrams for remote control and monitoring from the sludge thickener control panel.

1.05 TOOLS

Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 GATE VALVES

A. All buried valves shall have cast or ductile iron three (3) piece valve bodies.

B. Where indicated on the drawings or necessary due to locations, size, or inaccessibility, chain wheel operators shall be furnished with the valves. Such operators shall be designed with adequate strength for the valves with which they are supplied and provide for easy operation of the valve. Chains for valve operators shall be galvanized.

C. Where required, gate valves shall be provided with a box cast in a concrete slab and a box cover. Length of box shall include slab thickness. Box cover opening shall be for valve stem and nut. Valve wrenches and extension stems shall be provided by the manufacturer to actuate the valves. The floor box and cover shall be equal to those manufactured by Rodney Hunt Machine Company, Orange, Massachusetts, Clow, DeZurik or approved equal.

D. Gate valves with 3"-20" diameters shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 or C515 and UL/FM of latest revision and in accordance with the following specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

E. Wrench nut shall be provided for operating the valve.

F. Valves shall be suitable for an operating pressure of 200 psi and shall be tested in

accordance with AWWA C509 or C515. Mueller, Kennedy, M&H, and Clow are acceptable valves.

G. All bonnet bolts, nuts and studs shall be stainless steel.

2.02 PRESSURE SUSTAINING AND CHECK VALVE

A. Pressure sustaining and check valve shall be pilot operated diaphragm actuated valve with cast iron body, bronze trim, and 125-pound flanged ends. The valve shall be hydraulically operated, diaphragm type globe valve. The main valve shall have a single removable seat and a resilient disc, of rectangular cross section, surrounded on three and a half sides. The stainless steel stem shall be fully guided at both ends by a bearing in the valve cover, and an integral bearing in the valve seat. It shall be sleeved at both ends with delrin. No external packing glands are permitted and there shall be no pistons operating the main valve or any controls. The valve shall be equipped with isolation cocks to service the pilot system while permitting flow if necessary. Main valve and all pilot controls shall be manufactured in the United States of America. Valve shall be single chamber type, with seat cut to 5 degrees taper.

B. Valve shall maintain a minimum (adjustable) upstream pressure to a preset (adjustable) maximum. The pilot system shall consist of two direct acting, adjustable, spring loaded diaphragm valves.

C. Valve shall be cast iron (ASTM A48) with main valve trim of brass (QQB-B-626) and bronze (ASTM B61). The pilot control valves shall be cast brass (ASTM B62) with 303 stainless steel trim. All ferrous surfaces inside and outside shall have a 2-part epoxy coating. Valve shall be similar in all respects to CLA-VAL Company, Model 692G-01ABKG, as manufactured by CLA-VAL Company, Winter Park, Florida, or similar pressure sustaining and check valve as manufactured by Golden Alderson; or approved equal.

2.03 BALL VALVES FOR PVC PIPE

A. Ball valves for PVC pipe shall be of PVC Type 1 with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Celanese Piping Systems, Inc., Wallace and Tiernan, Inc., Plastiline, Inc., or approved equal.

B. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

2.04 BUTTERFLY VALVES

A. Butterfly valves shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designated C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B, except that valves furnished downstream of the high service pumps shall be Class 250 and equal to those manufactured by Henry Pratt Company, DeZurik, Mueller, or approved equal. M&H/Kennedy/Clow are not generally approved equals. Ductile iron conforming to ASTM A536, Grade 65-45-12 shall be provided for all Class 250 valves. All valves shall be leak tested at 200 psi.

B. The face-to-face dimensions of flanged end valves shall be in accordance with Table 1 of above mentioned AWWA Specification for short-body valve. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1.

C. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of the 1/8-inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where the EPDM seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where the EPDM seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

D. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Butterfly valves of the "wafer" or "spool" type will not be accepted.

E. The valve shaft shall be turned, ground, and polished constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.

F. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The hydrostatic test for Class 250 valves shall be performed with an internal hydrostatic pressure equal to 500 psi applied to the inside of the valve body of each valve for a period of five minutes. During the hydrostatic test, there shall be no leakage through the metal, the end joints or the valve shaft seal. The leakage test for the Class 250 valves shall be performed at a differential pressure of 230 psi and against both sides of the valve. No adjustment of the valve disc shall be necessary after pressure test for normal operation of valve. The Class 150 valves shall be tested in conformance with AWWA C-504.

G. In general, the butterfly valve operators shall conform to the requirements of Section 3.8 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable, and as herein specified.

H. Gearing for the operators shall be totally enclosed in a gear case in accordance with paragraph 3.8.3 of the above mentioned AWWA Standard Specification.

I. Operators shall be capable of seating and unseating the disc against the full design pressure of velocity, as specified for each class, into a dry system downstream and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.

J. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform with all requirements of this Specification and the AWWA standard.

K. Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

2.05 PLUG VALVES

A. All plug valves shall be eccentric plug valves capable of sustaining 150 psi in either direction without leaking.

Exception: Single direction plug valves may be used if it is clearly demonstrated they will never be required to resist pressure in both directions either in service or during pipe line testing.

B. Plug valves shall be tested in accordance with current AWWA Standard C-504-80 Section 5. Each valve shall be performance tested in accordance with paragraph 5.2 and shall be given a leakage test and hydrostatic test as described in paragraphs 5.3 and 5.4. Plug valves shall be Kennedy or Dezurik.

C. Plug valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the Plans. Flanged valves shall be faced and drilled to the ANSI 150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-72. Bell ends shall be to the AWWA Standard C100-55 Class B. Screwed ends shall be to the NPT standard.

D. Plug valve bodies shall be of ASTM A126 Class B Semi-steel, 31,000 psi tensile strength minimum in compliance with AWWA Standard C507-73, Section 5.1 and AWWA Standard C504-70 Section 6.4. Port areas for valves 20-inches and smaller shall be 80 percent of full pipe area. Valves 24 inch and larger shall have a minimum port area between 80 and 100 percent of full nominal pipe area. All exposed nuts, bolts, springs, washers, etc. shall be zinc or cadmium plated. Resilient plug facings shall be of Hycar or Neoprene.

E. Plug valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower plug stem bushings. These bearings shall comply with current AWWA Standards.

2.06 VALVE ACTUATORS

A. General

1. All valve actuators shall conform to Section 3.8 of the AWWA Standard Specification and shall be either manual or motor operated.
2. Actuators shall be capable of seating and unseating the disc against the full design pressure and velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.
3. Butterfly valve actuators shall conform to the requirements of Section 3.8 of the AWWA Standard specifications for Rubber Seated Butterfly Valves, Designated C504, insofar as applicable and as herein specified.

B. Manual Actuators

1. Manual actuators shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Actuators shall be equipped with handwheel, position indicator, and mechanical

stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves. Manual actuators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chainwheel. Actuator components shall withstand an input of 450 foot pounds for 30" and smaller and 300 foot pounds for larger than 30" size valves at extreme actuator positions without damage. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a two inch (2") square AWWA operating nut located at ground level and cast iron extension type valve box. Valve actuators shall conform to AWWA C504, latest revision.

C. Motor Actuators (Modulating)

1. The motor actuated valve controller shall include the motor, actuator unit gearing, limit switch gearing, limit switches, position transmitter which shall transmit a 4-20 mA DC signal, control power transformer, electronic controller which will position the valve based on a remote 4-20 milliamp signal, torque switches, bored and key-wayed drive sleeve for non-rising stem valves, declutch lever and auxiliary handwheel as a self-contained unit.
2. The motor shall be specifically designed for valve actuator service using 480 volt, 60 Hertz, three phase power as shown, on the electrical drawings. The motor shall be sized to provide an output torque and shall be the totally enclosed, non-ventilated type. The power gearing shall consist of helical gears fabricated from heat treated alloy steel forming the first stage of reduction. The second reduction stage shall be a single stage worm gear. The worm shall be of alloy steel with carburized threads hardened and ground for high efficiency. The worm gear shall be of high tensile strength bronze with hobbed teeth. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. Preference will be given to units having a minimum number of gears and moving parts. Spur gear reduction shall be provided as required.
3. Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be made of bronze and shall be grease lubricated, intermittent type and totally enclosed to prevent dirt and foreign matter from entering the gear train. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve.
4. The speed of the actuator shall be the responsibility of the system supplier with regard to hydraulic requirements and response compatibility with other components within the control loop. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing. The rotor type gear limit switch shall have two normally open and two normally closed contacts per rotor. Gear limit switches must be geared to the driving mechanism and in step at all times whether in motor or manual operation. Provision shall be made for two additional rotors as described above, each to have two normally open and two normally closed contacts. Each valve controller shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve, should excessive load be met by obstructions in either direction of travel. The torque switch shall be provided with double-pole contacts.

5. A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operations, but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running. The gear limit switches and torque switches shall be housed in a single easily accessible compartment integral with the power compartment of the valve control. All wiring shall be accessible through this compartment. Stepping motor drives will not be acceptable.
6. The motor with its control module must be capable of continuously modulating over its entire range without interruption by heat protection devices. The system, including the operator and control module must be able to function, without override protection of any kind, down to zero dead zone.
7. All units shall have strip heaters in both the motor and limit switch compartments.
8. The actuator shall be equipped with open-stop-close push buttons, an auto-manual selector switch, and indicating lights, all mounted on the actuator or on a separate locally mounted power control station.
9. The electronics for the electric operator shall be protected against temporary submergence.
10. Actuators shall be Limitorque L120 with Modutronic Control System containing a position transmitter with a 4-20MA output signal or equal.

D. Motor Actuators (Open-Close)

1. The electronic motor-driven valve actuator shall include the motor, actuator gearing, limit switch gearing, limit switches, torque switches, fully machined drive sleeve, declutch lever, and auxiliary handwheel as a self-contained unit.
2. The motor shall be specifically designed for valve actuator service and shall be of high torque totally enclosed, nonventilated construction, with motor leads brought into the limit switch compartment without having external piping or conduit box.
   (a) The motor shall be of sufficient size to open or close the valve against maximum differential pressure when voltage to motor terminals is 10% above or below nominal voltage.
   (b) The motor shall be prelubricated and all bearings shall be of the anti-friction type.
3. The power gearing shall consist of helical gears fabricated from heat treated steel and worm gearing. The worm shall be carburized and hardened alloy steel with the threads ground after heat treating. The worm gear shall be of alloy bronze accurately cut with a hobbing machine. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout.
4. Limit switches and gearing shall be an integral part of the valve actuator. The switches shall be of the adjustable rotor type capable of being adjusted to trip at any point between fully opened valve and fully closed valve. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing (influent valves require additional contacts to allow stopping at an intermediate position). The rotor type gear limit switch shall have

two normally open and two normally closed contacts per toro. Additional switches shall be provided if shown on the control and/or instrumentation diagrams. Limit switches shall be geared to the driving mechanism and in step at all times whether in motor or manual operation. Each valve actuator shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve should excessive load be met by obstructions in either direction of travel. Travel and thrusts shall be independent of wear in valve disc or seat rings.

5. A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation except when being electrically operated. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve actuator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. Movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running.
6. Valve actuators shall be equipped with an integral reversing controller and three phase overload relays, Open-Stop-Close push buttons, local-remote-manual selector switch, control circuit transformer, three-phase thermal overload relays and two pilot lights in a NEMA 4X enclosure. In addition to the above, a close coupled air circuit breaker or disconnect switch shall be mounted and wired to the valve input power terminals for the purpose of disconnecting all underground phase conductors.
7. The valve actuator shall be capable of being controlled locally or remotely via a selector switch integral with the actuator. In addition, an auxiliary dry contact shall be provided for remote position feedback.
8. Valve A.C. motors shall be designed for operation on a 480 volt, 3-phase service. Valve control circuit shall operate from a fuse protected 120 volt power supply.
9. Motor operators shall be as manufactured by Limitorque Corporation, Type L120 or approved equal.

2.07 AIR RELEASE VALVES

The air release valves for use in water or force mains shall be installed as shown on the Drawings. The valves shall have a cast iron body cover and baffle, stainless steel float, bronze water diffuser, Buna-N or Viton seat, and stainless steel trim. The fittings shall be threaded. The air release valves shall be Model 200A or 400A as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois; or approved equal.

2.08 VALVE BOXES

A. Buried valves shall have cast-iron three piece valve boxes or HDPE adjustable valve boxes. Cast iron valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the County. The barrel shall be two-piece, screw type, having a 5-1/4 inch shaft. The upper section shall have a flange at the bottom with sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have WATER, SEWER, or RECLAIM, as applicable, cast into the top. Lids will be painted “safety” blue for potable,

purple for reclaimed, and green for sanitary sewer.

B. All valves shall have actuating nuts extended to within four (4) feet of the top of the valve box. All valve extensions will have a centering guide plate two (2) inches maximum below the actuating nut. The valve extension shall be fastened to the existing nut with a set screw. Valve boxes shall be provided with a concrete base and a valve nameplate engraved with lettering 1/8-inch deep as shown on the Drawings.

C. HDPE adjustable valve boxes shall be one complete assembled unit composed of the valve box and extension stem. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths.

D. The entire assembly shall be made of heavy wall high density polyethylene. All exterior components shall be joined with stainless steel screws. The valve box top section shall be adaptable to fit inside a valve box upper section.

E. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The stem material shall be of plated steel square tubing. The stem assembly shall have a built-in device that keeps the stem assembly from disengaging at its fully extended length. The extension stem must be torque tested to 1000 foot pounds. Covers shall have WATER, SEWER or RECLAIMED clearly and permanently impressed into the top surface.

2.09 CORPORATION COCKS

Corporation cocks for connections to cast-iron, ductile iron or steel piping shall be all brass or bronze suitable for 180 psi operating pressure and similar to Mueller Co. H-10046 or approved equal by Clow Corp., and shall be of sizes required and/or noted on the Drawings.

2.10 FLANGE ADAPTER COUPLINGS

Flange adapter couplings shall be of the size and pressure rating required for each installation and shall be suitable for use on either cast iron or ductile iron pipe. They shall be similar or approved equal to Dresser Company, Style 128. All couplings shall have a sufficient number of factory installed anchor studs to meet or exceed a minimum test pressure rating of 230 psi minimum.

2.11 FLEXIBLE COUPLINGS

Flexible couplings shall be either the split type or the sleeve type as shown on the Drawings.

1. Split type coupling shall be used with all interior piping and with exterior pipings noted on the Drawings. The couplings shall be mechanical type for radius groove piping. The couplings shall mechanically engage and lock grooved pipe ends in a positive couple and allow for angular deflection and contracting and expansion.
2. Couplings shall consist of malleable iron, ASTM Specification A47, Grade 32510 housing clamps in two or more parts, a single chlorinated butyl composition sealing gasket with a "C" shaped cross-section and internal sealing lips projecting diagonally inward, and two or more oval track head type bolts with hexagonal

heavy nuts conforming to ASTM Specification A 183 and A194 to assemble the housing clamps. Bolts and nuts shall be hot dipped galvanized after fabrication.

3. Victualic type couplings and fittings may be used in lieu of flanged joints. Pipes shall be radius grooved as specified for use with the Victaulic couplings. Flanged adapter connections at fittings, valves, and equipment shall be Victaulic Vic Flange Style 741, equal by Gustin-Bacon Group, Division of Certain-Teed Products, Kansas City, Kansas, or approved equal.
4. Sleeve type couplings shall be used with all buried piping. The couplings shall be of steel and shall be Dresser Style 38 or 40, as shown on the Drawings, or equal. The coupling shall be provided with hot dipped galvanized steel bolts and nuts unless indicated otherwise.
5. All couplings shall be furnished with the pipe stop removed.
6. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.
7. If the Contractor decides to use victaulic couplings in lieu of flanged joints, he shall be responsible for supplying supports for the joints.

2.12 HOSE BIBS

Hose bibs shall be 3/4" or 1" brass, polished chromium plated brass, with vacuum breaker as noted on the drawings.

2.13 SLOW CLOSING AIR AND VACUUM VALVES

A. The Contractor shall furnish and install slow closing air and vacuum valves as shown on the Drawings which shall have two (2) independent valves bolted together. The air and vacuum valve shall have all stainless steel float, guided on both ends with stainless shafts. The air and vacuum valve seat shall be Buna-N to insure drop tight closure. The Buna-N seat shall be fastened to the cover stainless shoulder screws in a manner to prevent distortion of the seat. The float shall be guided at both ends with stainless steel bushings.

B. The valve cover shall have a male lip designed to fit into the body register for accurate alignment of the float into the Buna-N seat. The valve cover shall have 250-pound class flanged outlet connection.

C. The surge check valve shall be bolted to the inlet of the air and vacuum valve and consist of a body, seat, disc, and compression spring. A surge check unit shall operate on the interphase between the kinetic energy and relative velocity flows of air and water, so that after air passes through, and water rushes into the surge check, the disc starts to close, reducing the rate of flow of water into the air valve by means of throttling orifices in the disc to prevent water hammer in the air valves. The surge check orifices must be adjustable type for regulation in the field to suit operating conditions. Valve shall be rated for 250-pound class working pressure.

D. The complete slow closing air and vacuum valve with air release valve shall have been flow tested in the field, substantiated with test data to show reduction of surge pressure in the valve. Flow test data shall be submitted with initial shop drawings for approval.

E. Valve exterior to be painted Red Oxide, Phenolic TT-P86, Primer or approved equal for high resistance to corrosion.

F. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

Air Valve Cover, Body, and Surge Check Body	Cast Iron	ASTM A48, Class 30
Float	Stainless Steel	ASTM A240
Surge Check Seat and Disc	Stainless Steel	ASTM A582
Air Valve Seat	Buna-N	
Spring	Stainless Steel	T302

2.14 SURGE ANTICIPATOR VALVES

A. Surge anticipator valves shall be furnished for the pumping systems as shown on the Drawings. The valve shall be hydraulically operated, pilot controlled, and diaphragm or piston actuated. The main valve shall be cast iron conforming to ASTM A48 with bronze trim conforming to ASTM B61 and flanged ends conforming to ANSI B161.1. The main valve shall be globe type with a single removable seat and a resilient disc.

B. The diaphragm actuated valve shall have a stainless steel stem guided at both ends by a bearing in the valve cover and an integral bearing surface in the seat. No external packing glands shall be permitted. The valve shall be fully serviceable without removing it from the line. The pilot system shall be of noncorrosive construction and provided with isolation cocks.

C. The piston actuated valve shall operate on the differential piston principle. The valve piston shall be guided on its outside diameter. The valve shall be able to operate in any position and shall be fully serviceable without removing it from the line. The pilot system shall be provided with isolation cocks, and be of noncorrosive materials of construction.

D. The valve shall be designed specifically to minimize the effects of water hammer, resulting from power failure at the pumping station, or from normal stopping and starting of pumping operators. The valve shall open hydraulically on a down surge, or low pressure wave created when the pump stops, remain open during the low pressure cycle in order to be open when the high pressure wave returns. The high pressure pilot shall be adjustable over a 20 to 200 psi range and the low pressure pilot shall be adjustable over a 15 to 75 psi range. The valve shall be the 250 Class.

2.15 CHECK VALVES

A. Check valves for cast iron and ductile iron pipe lines shall be swing type and shall meet the material requirements of AWWA Specification C508. The valves shall be iron body, bronze mounted, single disc, 175 psi working water pressure and nonshock. Valves shall be as manufactured by Mueller, Clow, Kennedy, or M&H. Valves 8” and larger shall be air cushioned to reduce valve slam.

B. When there is no flow through the line, the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

C. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers. The interior and exterior of the valve body shall have a factory applied fusion bonded or 10 mil 2 part epoxy coating (Protecto 401 or approved equal).

D. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. Weights provided and approved by the County shall be installed.

2.16 HYDRANTS

Hydrants shall be AVK Series 2780 Barrel (nostalgic style with stainless steel bolts) American Darling B-84-B or Mueller Super Centurian 250, or approved equal and shall conform to the "Standard Specification for Fire Hydrants for Ordinary Water Works Service", AWWA C502, and UL/FM certified, and shall in addition meet the specific requirements and exceptions which follow:

1. Hydrants shall be according to manufacturer's standard pattern and of standard size, and shall have one 4-1/2" steamer nozzle and two 2-1/2" hose nozzles.
2. Hydrant inlet connections shall have mechanical joints for 6" ductile-iron pipe.
3. Hydrant valve opening shall have an area at least equal to that area of a 5-1/4" minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons minimum through its two 2-1/2" hose nozzles when opened together with a loss of not more than 2 psi in the hydrants.
4. Each hydrant shall be designed for installation in a trench that will provide 5-ft. cover.
5. Hydrants shall be hydrostatically tested as specified in AWWA C502.
6. Hydrants shall be rated at 200 psi.
7. All nozzle threads shall be American National Standard.
8. Each nozzle cap shall be provided with a Buna N rubber washer.
9. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism and without the mechanism obstructing the discharge from any outlet.
10. Hydrants must be capable of being extended without removing any operating parts.
11. Hydrants shall have bronze-to-bronze seatings as per AWWA C502-85.
12. Hydrant main valve closure shall be of the compression type opening against the pressure and closing with the pressure. The resilient seat material shall meet the requirements of AWWA C-509 and shall preferably be EPDM Elastomer.
13. Internal and below ground iron parts (bonnet, nozzle section and base) shall have a fusion bonded epoxy coating per AWWA C550. Aboveground external hydrant parts (cap, bonnet and nozzle section) shall be either epoxy coated together with a UV resistant polyester coating or have two shop coats of paint per AWWA C502. The lower stand pipe or barrel shall be protected with asphaltic coatings per AWWA C502.
14. Exterior nuts, bolts and washer shall be stainless steel. Bronze nuts may be used below grade.
15. All internal operating parts shall be removable without requiring excavation.

2.17 RESTRAINING CLAMPS

Restraining clamp assemblies as detailed in the drawings for use at hydrant connections to water mains, or at fittings where shown on the Drawings, shall be as manufactured by American Cast Iron Pipe, Star Pipe Products, U.S. Pipe; or approved equal.

2.18 TAPPING SLEEVES AND GATE VALVES

A. Tapping valves shall meet the requirement of AWWA C500. The valves shall be flanged, shall be mechanical joint outlet with nonrising stem, designed for vertical burial and shall open left or counterclockwise. Stuffing boxes shall be the "O-ring" type. Operating nut shall be AWWA Standard 2" square for valves 2" and up. The valves shall be provided with an overload seat to permit the use of full size cutters. Gaskets shall cover the entire area of flange surfaces and shall be supplied with EPDM wedges up to 30" diameter.

B. Tapping sleeves and saddles shall seal to the pipe by the use of a confined "O" ring gasket, and shall be able to withstand a pressure test of 180 psi for one hour with no leakage in accordance with AWWA C110, latest edition. A stainless steel 3/4" NPT test plug shall be provided for pressure testing. All bolts joining the two halves shall be stainless steel and shall be included with the sleeve or saddle. Sleeves and saddles shall be protected from corrosion by being fusion applied epoxy coated, or be made of 18-8 Type 304 stainless steel. Saddle straps shall be 18-8 Type 304 stainless steel.

2.19 SINGLE ACTING ALTITUDE VALVES

A. Function

1. The altitude control valve shall be of the single acting type, closing off tightly when the water reaches the maximum predetermined level in the tank to prevent overflow; and opening to permit replenishing of the tank supply when the water level drops approximately 6" to 12" below the maximum level.
2. A hand operated valve in the power water line to the top of the piston shall permit adjustment of the speed of valve closing. The tank water level control shall be by means of a diaphragm operated, spring loaded, three way pilot which directs power water to or from the top of the main valve piston. The three way pilot shall be of bronze construction. The diaphragm surface exposed to the tank head shall be not less than 57 sq. inches. It shall be possible to adjust the spring above the diaphragm for water level control approximately 20% above or below the factory setting.

B. Description

1. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area on the upper surface of the piston is of a greater area than the underside of the piston.
2. The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be done by the valve Vee ports and not the valve seating surfaces.
3. The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible.

There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.

C. Construction

1. The valve body shall be of cast iron ASTM A-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.
2. The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.
3. All controls and piping shall be of non-corrosive construction.
4. A visual valve position indicator shall be provided for observing the valve piston position at any time.

D. Figure Number

The valves shall be the 20" Globe type (Fig. 3200-D) as manufactured by GA Industries of Mars, Pennsylvania, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage occurring to the above items before they are installed shall be repaired to the satisfaction of the County.

B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the County.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections.

E. Flanged joints shall be made with high strength, low alloy Corten bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.

F. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be

slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.

G. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8". Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6" from the end.

H. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and the top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 HYDRANTS

A. Hydrants shall be set at the locations designated by the County and/or as shown on the Drawings and shall be bedded on a firm foundation. A drainage pit on crushed stone as shown on the Drawings shall be filled with gravel or crushed stone and satisfactorily compacted. During backfilling, additional gravel or crushed stone shall be brought up around and 6" over the drain port. Each hydrant shall be set in true vertical alignment and shall be properly braced. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the plans. Felt paper shall be placed around the hydrant elbow prior to placing concrete. CARE MUST BE TAKEN TO INSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS. Concrete used for backing shall be as specified herein.

B. When installations are made under pressure, the flow of water through the existing main shall be maintained at all times. The diameter of the tap shall be a minimum of 2" less than the inside diameter of the branch line.

C. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under the supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor if tap is larger than 12" in diameter.

D. The Contractor shall determine the locations of the existing main to be tapped to confirm the fact that the proposed position for the tapping sleeve will be satisfactory and no interference will be encountered such as the occurrence of existing utilities or of a joint or fitting at the location proposed for the connection. No tap will be made closer than 30" from a pipe joint.

E. Tapping valves shall be set in vertical position and be supplied with a 2" square operating nut for valves 2" and larger. The valve shall be provided with an oversized seat to permit the use of full sized cutters.

F. Tapping sleeves and valves with boxes shall be set vertically or horizontally as indicated on the Drawings and shall be squarely centered on the main to be tapped. Adequate

support shall be provided under the sleeve and valve during the tapping operation. Sleeves shall be no closer than 30" from water main joints. Thrust blocks shall be provided behind all tapping sleeves. Proper tamping of supporting earth around and under the valve and sleeve is mandatory. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean.

3.03 SHOP PAINTING

Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.04 FIELD PAINTING

All metal valves and appurtenances specified herein and exposed to view shall be painted.

All above ground potable water main valves shall be painted safety blue.

3.05 INSPECTION AND TESTING

Completed pipe shall be subjected to hydrostatic pressure test for two hours at 180 psi. All leaks shall be repaired and lines retested as approved by the County. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

DIVISION 3 CONCRETE

SECTION 03200 CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 WORK INCLUDED

A. Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete, complete with tie wire.

B. Support chairs, bolsters, bar supports and spacers, for reinforcing.

1.02 QUALITY ASSURANCE

Perform concrete reinforcing work in accordance with ACI 318 unless specified otherwise in this Section.

1.03 REFERENCES

A. ACI 318 - Building Code Requirements for Reinforced Concrete.

B. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

C. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

D CRSI 63 - Recommended practice for placing reinforcing bars.

E. CRSI 65 - Recommended practice for placing bar supports, specifications and nomenclature.

F. ACI 315 - American Concrete Institute - Manual of Standard Practice.

1.04 SHOP DRAWINGS

A. Submit shop drawings in accordance with Contract Documents.

B. Indicate bar sizes, spacings, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules and supporting and spacing devices.

C. Manufacturer's Literature: Manufacturer's specifications and installation instructions for splice devices.

PART 2 PRODUCTS

2.01 REINFORCING

A. Reinforcing steel: Grade 60, Minimum Yield Strength 60,000 psi, deformed billet steel bars, ASTM A615; plain finish.

B. Welded steel wire fabric: Deformed wire, ASTM A497; smooth wire ASTM A185 in flat sheets; plain finish.

2.02 ACCESSORY MATERIALS

A. Tie wire: Minimum 16 gauge annealed type, or patented system accepted by County.

B. Chairs, bolsters, bar supports, spacers: Sized and shaped for strength and support of reinforcing during construction conditions.

C. Special chairs, bolsters, bar supports, spacers (where adjacent to architectural concrete surfaces): Stainless steel type sized and shaped as required.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 315.

B. Locate reinforcing splices, not indicated on Drawings, at points of minimum stress. Location of splices shall be reviewed by County.

C. Where indicated, weld reinforcing bars in accordance with AWS D12.1.

PART 3 EXECUTION

3.01 PLACEMENT

A. Reinforcing shall be supported and secured against displacement. Do not deviate from true alignment.

B. Before placing concrete, ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings which would reduce bond to concrete.

3.02 QUALITY ASSURANCE

A. Acceptable Manufacturers: Regularly engaged in manufacture of steel bar and welded wire fabric reinforcing.

B. Installer Qualifications: Three years experience in installation of steel bar and welded wire fabric reinforcing.

C. Allowable Tolerances:

1. Fabrication:
   a. Sheared length: +l in.
   b. Depth of truss bars: +0, -1/2 in.
   c. Stirrups, ties and spirals: $\pm$1/4 in.
   d. All other bends: $\pm$1 in.
2. Placement:
   a. Concrete cover to form surfaces: $\pm$1/4 in.
   b. Minimum spacing between bars: 1 in.
   c. Top bars in slabs and beams:

(1) Members 8 in. deep or less: ±1/4 in.
(2) Members more than 8 in.: ±1/2 in.

d. Crosswise of members: Spaced evenly within 2 in. of stated separation.

e. Lengthwise of members: Plus or minus 2 in.

3. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 1 bar diameter.

3.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Handle and store materials to prevent contamination.

3.05 INSTALLATION

A. Placement:

1. Bar Supports: CRSI 65.
2. Reinforcing Bars: CRSI 63.

B. Steel Adjustment:

1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
2. Do not move bars beyond allowable tolerances without concurrence of County.
3. Do not heat, bend, or cut bars without concurrence of County.

C. Splices:

1. Lap splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
2. Splice devices: Install in accordance with manufacturer's written instructions.
3. Do not splice bars without concurrency of County, except at locations shown on Drawings.

D. Wire Fabric:

1. Install in longest practicable length.
2. Lap adjoining pieces one full mesh minimum, and lay splices with 16 gauge wire.
3. Do not make end laps midway between supporting beams, or directly over beams of continuous structures.
4. Offset end laps in adjacent widths to prevent continuous laps.

E. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.

F. Protection During Concreting: Keep reinforcing steel in proper position during concrete placement.

END OF SECTION

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SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

Poured-in-place concrete slabs, thrust blocks, pile caps and pipe support cradles.

1.02 QUALITY ASSURANCE

Perform cast-in-place concrete work in accordance with ACI 318, unless specified otherwise in this Section.

1.03 TESTING LABORATORY SERVICES

A. Inspection and testing will be performed by the testing laboratory currently under contract to Manatee County in accordance with the Contract Documents.

B. Provide free access to work and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of work.

D. Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

E. Three concrete test cylinders will be taken for every 100 cu. yds. or part thereof of each class of concrete placed each day. Smaller pours shall have cylinders taken as directed by the County.

F. One slump test will be taken for each set of test cylinders taken.

1.04 REFERENCES

A. ASTM C33 - Concrete Aggregates

B. ASTM C150 - Portland Cement

C. ACI 318 - Building Code Requirements for Reinforced Concrete

D. ASTM C260 - Air Entraining Admixtures for Concrete

E. ASTM C94 - Ready-Mixed Concrete

F. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

G. ACI 305 - Recommended Practice for Hot Weather Concreting

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: Moderate-Type II, High early strength-Type III, Portland type, ASTM C150.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

2.02 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494 Type A - water reducing admixture.

2.03 ACCEPTABLE MANUFACTURERS

Acceptable Products:

1. Pozzolith
2. WRDA

2.04 ACCESSORIES

Non-shrink grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2400 psi in 2 days and 7000 psi in 28 days.

2.05 CONCRETE MIXES

A. Mix concrete in accordance with ASTM C94.

B. Provide concrete of following strength:

1. Required concrete strengths as determined by 28 day cylinders shall be as shown on the Drawings, but shall not be less than 3000 psi.
2. Select proportions for normal weight concrete in accordance with ACI 301 3.8 Method 1, Method 2, or Method 3. Add air entraining agent to concrete to entrain air as indicated in ACI 301 Table 3.4.1.
3. All mixes shall be in accordance with FDOT Specifications.

C. Use set-retarding admixtures during hot weather only when accepted by County.

D. Add air entraining agent to concrete mix for concrete work exposed to exterior.

2.06 FORMS

A. Forms shall be used for all concrete masonry, including footings. Form shall be so constructed and placed that the resulting concrete will be of the shape, lines, dimensions, appearance and to the elevations indicated on the Drawings.

B. Forms shall be made of wood, metal, or other approved material. Wood forms shall be

constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots; where used for expose surfaces, boards shall be dressed and matched. Plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be of an approved type for the class of work involved and of the thickness and design required for rigid construction.

C. Edges of all form panels in contact with concrete shall be flush within 1/32-inch and forms for plane surfaces shall be such that the concrete will be plane within 1/16-inch in four feet. Forms shall be tight to prevent the passage of mortar and water and grout.

D. Forms for walls shall have removable panels at the bottom for cleaning, inspection and scrubbing-in of bonding paste. Forms for walls of considerable height shall be arranged with tremies and hoppers for placing concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or reinforcement above the fresh concrete.

E. Molding or bevels shall be placed to produce a 3/4-inch chamfer on all exposed projecting corners, unless otherwise shown on the Drawings. Similar chamfer strips shall be provided at horizontal and vertical extremities of all wall placements to produce "clean" separation between successive placements as called for on the Plans.

F. Forms shall be sufficiently rigid to withstand vibration, to prevent displacement or sagging between supports and constructed so the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy.

G. Forms, including new pre-oiled forms, shall be oiled before reinforcement is placed, with an approved nonstaining oil or liquid form coating having a non-paraffin base.

H. Before form material is re-used, all surfaces in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, all protrusions smoothed and in the case of wood forms pre-oiled.

I. Form ties encased in concrete shall be designed so that after removal of the projecting part, no metal shall be within 1-inch of the face of the concrete. That part of the tie to be removed shall be at least 1/2-inch diameter or be provided with a wood or metal cone at least 1/2-inch in diameter and 1-inch long. Form ties in concrete exposed to view shall be the cone-washer type equal to the Richmond "Tyscru". Throughbolts or common wire shall not be used for form ties.

PART 3 EXECUTION

3.01 PLACING CONCRETE

A. Place concrete in accordance with ACI 304.

B. Notify County minimum 24 hours prior to commencement of concreting operations.

C. Verify anchors, seats, plates and other items to be cast into concrete are placed, held securely and will not cause hardship in placing concrete. Rectify same and proceed with work.

D. Maintain records of poured concrete items. Record date, location of pour, quantity, air

temperature and test samples taken.

E. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

F. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's recommendations.

G. Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.

H. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solidly with non-shrink grout.

I. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify County upon discovery.

J. Conform to ACI 305 when concreting during hot weather.

3.02 SCREEDING

Screed surfaces level, maintaining flatness within a maximum deviation of 1/8" in 10 feet.

3.03 PATCHING

Allow County to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as directed. All patching procedures shall be submitted to and approved by the County prior to use.

3.04 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required lines, details and elevations.

B. Repair or replace concrete not properly placed resulting in excessive honeycomb and other defects. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon express direction of County for each individual area.

3.05 CONCRETE FINISHING

Provide concrete surfaces to be left exposed, columns, beams and joists with smooth rubbed finish.

3.06 CURING AND PROTECTION

Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for a period of 7 days or until concrete strengths reaches 75% of the 28 day design strength.

Protection against moisture loss may be obtained with spray on curing compounds or plastic sheets. Protection against heat or cold may be obtained with insulated curing blankets or forms.

3.07 CONCRETE DRIVEWAY RESTORATION

Concrete driveways shall be restored with 6 inches of 3,000 psi concrete with W2.5 X W2.5, 6X6 wire mesh. Place ½ inch expansion joint between back of curb and new concrete. Area beneath restoration shall be mechanically tamped prior to placing concrete.

3.08 CONCRETE SIDEWALK RESTORATION

Concrete sidewalks across driveways shall be restored with 6 inches of 3,000 psi concrete with W2.5 X W2.5, 6X6 wire mesh. Place ½ inch expansion joint between back of curb and new concrete. Area beneath restoration shall be mechanically tamped prior to placing concrete.

Concrete sidewalks outside of driveways shall be restored with 4 inches of 3,000 psi concrete per FDOT Design Standards, Sections 522 & 310

END OF SECTION

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SECTION 03350 CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to finish cast-in-place concrete surfaces as specified herein.

1.02 SUBMITTALS

Submit to the County as provided in the Contract Documents, the proposed chemical hardener manufacturer's surface preparation and application procedures.

1.03 SCHEDULE OF FINISHES

A. Concrete for the Project shall be finished in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section.

B. The base concrete for the following conditions shall be finished as noted and as further specified herein:

1. Exterior, exposed concrete slabs and stairs - broomed finish.
2. Interior, exposed concrete slabs - steel trowel finish.
3. Concrete on which process liquids flow or in contact with sludge - steel trowel finish.
4. Concrete where not exposed in the finished work and not scheduled to receive an additional applied finish or material - off-form finish.
5. Provide concrete surfaces to be left exposed such as walls, columns, beams and joists with smooth rubbed finish.

1.04 RESPONSIBILITY FOR CHANGING FINISHES

A. The surface finishes specified for concrete to receive additional applied finishes or materials are the finishes required for the proper application of the actual products specified under other Sections. Where different products are approved for use, it shall be the Contractor's responsibility to determine if changes in finishes are required and to provide the proper finishes to receive these products.

B. Changes in finishes made to accommodate product different from those specified shall be performed at no additional cost to the County. Submit the proposed new finishes and their construction methods to the County for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland cement and component materials required for finishing the concrete surfaces shall be as specified in the Contract Documents.

B. Hardener shall be Lapidolith as manufactured by Sonneborn Building Products or approved equal. Hardener shall be used on all floors, stair treads and platforms.

PART 3 EXECUTION

3.01 FORMED SURFACES

A. Forms shall not be stripped before the concrete has attained a strength of at least 50 percent of the ultimate design strength. This is equivalent to approximately five "100 day-degrees" of moist curing.

B. Care shall be exercised to prevent damaging edges or obliterating the lines of chamfers, rustications, or corners when removing the forms or doing any work adjacent thereto.

C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the County.

D. Off-form finish. Fins and other projections shall be removed as approved. Tie cone holes and other minor defects shall be filled with non-shrink grout specified under the Contract Documents.

3.02 FLOORS AND SLABS

A. Floors and slabs shall be screeded to the established grades and shall be level with a tolerance of 1/8-inch when checked with a 10 foot straight edge, except where drains occur, in which case floors shall be pitched to drains as indicated. Failure to meet either of above shall be cause for removal, grinding, or other correction as approved by the County.

B. Following screeding as specified above, power steel trowel as follows:

1. Immediately after final screeding, a dry cement/sand shake in the proportion of 2-sacks of portland cement to 350-pounds of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 pounds per 1,000 square feet of floor. Neat, dry cement shall not be sprinkled on the surface. This shake shall be thoroughly floated into the surface with an approved disc type power compacting machine weighing at least 200 pounds if a 20-inch disc is used or 300 pounds if a 24-inch disc is used (such as a "Kelly Float" as manufactured by the Weisner-Rapp Corporation of Buffalo, New York). A mechanical blade-type float or trowel is not acceptable for this work.
   NOTE: This operation (application of the cement/sand shake) may be eliminated at the discretion of the County if the base slab concrete exhibits adequate fattiness and homogeneity.
2. In lieu of power steel troweling, small areas as defined by the County shall be compacted by hand steel troweling with the dry cement/sand shake as ordered.
3. The floor or slab shall be compacted to a smooth surface and the floating operation continued until sufficient mortar is brought to the surface to fill all voids. The surfaces shall be tested with a straight edge to detect high and low spots which shall be eliminated.
4. Compaction shall be continued only until thorough densification is achieved and a small amount of mortar is brought to the surface. Excessive floating shall be avoided.

C. After Paragraph 3.02 A and B procedures are accomplished, floors and slabs for particular conditions shall be completed as scheduled in one of the following finishes:

1. Wood float finish. Hand wood float, maintaining the surface tolerance to provide a grained, nonslip finish as approved.
2. Broomed finish. Hand wood float maintaining the surface tolerance and then broom with a stiff bristle broom in the direction of drainage to provide a nonslip finish as approved.
3. Steel trowel finish. Hand steel trowel to a perfectly smooth, hard even finish free from high or low spots or other defects as approved.

D. Floors, stair treads and platforms shall be given a floor hardener. Application shall be according to manufacturer's instructions.

3.03 APPROVAL OF FINISHES

A. All concrete surfaces will be inspected during the finishing process by the County.

B. Surfaces which, in the opinion of the County, are unsatisfactory shall be refinished or reworked until approved by the County.

END OF SECTION

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DIVISION 5 METALS

SECTION 05500 MISCELLANEOUS METAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, equipment and incidentals required and install covers, grates, frames and other miscellaneous metals as shown on the Drawings and specified herein. The miscellaneous metal items include but are not limited to the following:

1. All metal frames, ladders, stairs, stair rails, floor opening frames including gratings and supports.
2. Prefabricated access hatches and frames.
3. Anchors and anchor bolts except those specified to be furnished with all equipment.
4. Railings, posts and supports both interior and exterior.
5. Cast iron frames, covers, grates, drain leaders and drains.
6. Bridge crane track supports.
7. Stair nosings, steel plates, overhead steel door frames, angle frames, plates and channels.
8. Exterior H.V.A.C. hoods.
9. Pump guide rail system.

1.02 COORDINATION

A. The work in this Section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.03 SHOP DRAWINGS AND SAMPLES

A. Detail drawings, as provided for in the Contract Documents, showing sizes of members, method of assembly, anchorage, and connection to other members shall be submitted to the County for approval before fabrication.

B. Samples shall be submitted at the request of the County for concurrent review with Shop Drawings.

1.04 FIELD MEASUREMENTS

A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.

1.05 REFERENCED SPECIFICATIONS

A. Unless otherwise specified, materials shall conform to the following:

Structural Steel	ASTM A36
Welded & Seamless Steel Pipe	ASTM A53
Gray Iron Castings	ASTM A48, Class 30
Galvanizing, general	ASTM A123
Galvanizing, hardware	ASTM A153
Galvanizing, assemblies	ASTM A386
Aluminum (Extruded Shapes)	6061-T6 (Alum. alloy)
Aluminum (Extruded Pipe)	6061-T6 (Alum. alloy)
Aluminum Bar Structural	6061-T6 (Alum. alloy)
Bolts and Nuts	ASTM, A307
Stainless Steel Bolts, Fasteners	AISI, Type 316
Stainless Steel Plate and Sheet, Wire	AISI, Type 316
Welding Rods for Steel	AWS Spec. for Arc Welding

PART 2 PRODUCTS

2.01 ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchors, bolts, etc., shall be furnished as necessary for installation of the work of this Section.

B. Compound masonry anchors shall be of the type shown or required and shall be equal to Star Slug in compounded masonry anchors manufactured by Star Expansion Industries, equal by Phillips Drill Co., Rawlplug, or equal. Anchors shall be minimum "two unit" type.

C. The bolts used to attach the various members to the anchors shall be the sizes shown or required. Stainless steel shall be attached to concrete or masonry by means of stainless steel machine bolts and iron or steel shall be attached with steel machine bolts unless otherwise specifically noted.

D. For structural purposes, unless otherwise noted, expansion bolts shall be Wej-it "Ankr-Tite", Phillips Drill Co. "Wedge Anchors", or Hilti "Kwik-Bolt". When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete. Material shall be as noted on the Drawings. If not listed, all materials shall be stainless steel.

2.02 ALUMINUM ITEMS

A. Aluminum gratings shall be of serrated I-Bar Aluminum Alloy 6061-T6, fabricated to the depths and thicknesses shown on the Drawings and shall be Reliance Steel Products Company, I-Lok Type 7/8 R4 Aluminum Grating; IKG Industries, "Galok" Aluminum I-Bar Grating Type S194-I, or equal. All openings 2 inches and greater in diameter shall be banded with a bar of the same depth and thickness as the main bearing bars of the grating, or furnished with continuous cross bridges. Each cut bar shall be welded to the band if banding is utilized. The ends of all grating sections shall be likewise banded. Clamps and bolts used for attaching grating to supporting members shall be stainless steel. All grating shall be clamped unless noted otherwise. Clamps shall be as recommended by the manufacturer.

B. Stair treads shall be as specified above for grating and shall have abrasive nonslip nosing.

C. Aluminum nosing at concrete stairs shall be an extrusion of 4-inch minimum width with abrasive filled and shall be Wooster Products, Inc., Alumogrit Treads, Type 116; equal by Barry Pattern and Foundry Co.; Andco; or equal. Embedded anchors shall be furnished with a minimum of three anchors per tread.

D. Aluminum ladders shall be fabricated to the dimensions and details and installed as shown on the Drawings. Treads to be of cast aluminum by Dixie Metals, Inc. of Fort Lauderdale, Florida or equal.

E. Aluminum Handrails, Mechanically Fastened Type:

1. All aluminum mechanically fastened type pipe handrails and guardrails shall be clear anodized aluminum finish and installed as specified herein and indicated on the Drawings. Handrails shall be made of nominal 1-1/2 inches inside diameter pipe (Schedule 40) fabricated or seamless 6063-T6 alloy. The supplier of the handrail system shall supply all necessary fittings, rackets, transition, corner and connector pieces, toeboards, protective gaskets, etc., for a complete job at the locations, indicated on the Drawings. All mounting hardware including bolts, studs, nuts, etc., shall be stainless steel Type 316. Bends shall be smooth and accurate to the details shown. Railings shall be the "Rigid Rail System" as manufactured by Reynolds Aluminum of Reynolds Metal Company as Reynolds II pipe railing system or the "Connectorail System" as manufactured by Julius Blum & Co., Inc., Carlstadt, New Jersey. The handrail systems shall comply with all OSHA and D Section 1208.2 of the Standard Building Code.
2. Spacing of posts where posts are required shall be as noted on shop drawings, but in all cases, shall be uniform and shall not exceed the requirements of OSHA and Section 1208.2 of the Standard Building Code. Shorter spacing may be used where required to maintain the maximum spacing. The fabricator of the aluminum handrail and guardrail system shall be responsible for the design and preparation of shop drawings and design calculations (signed and sealed by Florida Registered Engineer) to meet OSHA requirements and Section 1208.2 of Standard Building Code.
3. All railings shall be erected in line and plumb. Field splicing and expansion compensation shall be accomplished using internal splice sleeves. Make provisions for removable railing sections as detailed and where shown on the Drawings.
4. Where handrail or guardrail posts are set in concrete as per the manufacturer's requirements the posts shall be set into aluminum sheeves cast in the concrete and firmly cemented with 1651 epoxy resin by E-Bond Epoxies, Oakland Park, Florida, Moulded Reinforced Plastics, Inc., Fort Lauderdale, Florida or equal. Collars shall be placed on the posts and fastened in place, as shown and as detailed on approved shop drawings.
5. Where handrail is supported from structural members, it shall be done by the use of approved sockets, flanges, brackets, or other approved means which will provide neat and substantial support for the pipe railing.
6. All railing shall be properly protected by paper, or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed.

F. Toeboards: Contractor shall furnish and install aluminum toeboards conforming to latest OSHA requirements on all railings and other locations where indicated on the Drawings.

1. Toeboards shall consist of an extruded 6063-T6 aluminum shape bolted by means of a pipe clamp to the railing posts without requiring any drilling or welding of the toeboard to the railing posts as manufactured by Reynolds Aluminum, Julies Blum & Company, Thompson Fabricating Company or equal. Toeboards shall have pitched top and tear drop bottom to prevent accumulation of dirt, or other material.
2. All fastening hardware shall be Type 316 stainless steel.

G. Kickplates, if required, shall be fabricated and installed as shown on the Drawings.

H. Aluminum safety gate shall be fabricated of extruded aluminum.

I. Prefabricated checkerplate aluminum floor hatches shall be Type "JD", or "KD" as manufactured by Bilco Co., Babcock-Davis Associates, Inc.; Type "AM" Inland-Ryerson Construction Products Co., Milcor Division; or equal, sized as shown. Hatches with either dimension over 3 feet-6 inches shall be double leaf type. Hatches shall be designed for a live load of 300 pounds per square foot. Hatches shall be watertight.

J. Ship ladders shall be of all aluminum construction as detailed. Treads shall have abrasive nosing as manufactured by Reliance Steel Products Co., IKG Industries, or equal.

K. Checkplate aluminum cover plates shall be fabricated to the details shown and installed at the locations shown.

L. Structural aluminum angle and channel door frames shall be provided as shown on the Drawings and shall be anodized. Frames shall be fabricated with not less than three anchors on each jamb.

M. Miscellaneous aluminum shapes and plates shall be fabricated as shown. Angle frames for hatches, beams, grates, etc., shall be furnished complete with welded strap anchors attached. Furnish all miscellaneous aluminum shown, but not otherwise detailed. Structural shapes and extruded items shall conform to the detail dimensions on the Plans within the tolerances published by the American Aluminum Association.

2.03 STEEL ITEMS

A. Sleeves shall be steel or cast iron pipe in walls and floors with end joints as shown on the Drawings. All pipe sleeves shall have center anchor around circumference as shown.

B. Miscellaneous steel pipe for sleeves and lifting attachments and other uses as required shall be Schedule 40 pipe fabricated according to the details as shown on the Drawings.

C. Miscellaneous steel shall be fabricated and installed in accordance with the Drawings and shall include: beams, angles, support brackets, closure angles in roof at edge of T-beams; base plates to support ends of T-beams; door frames; splice plates, anchor bolts; lintels and any other miscellaneous steel called for on the Drawings and not otherwise specified.

2.04 CAST IRON ITEMS

A. Outside pipe clean-out frames and covers shall be heavy duty, R-6013-R-6099 series as manufactured by Neenah Foundry Co., or equal. All outside pipe clean-outs shall be 6-inch diameter.

B. Frames and covers for valve vaults and manholes shall be of a good quality, strong, tough even grained cast iron except as otherwise specified below. Castings shall be as manufactured by the U. S. Foundry, Neenah Foundry, Mechanics Iron Foundry, or equal. Covers to have letters "WATER", "SEWER" or "DRAIN", as applicable, embossed on top.

PART 3 EXECUTION

3.01 FABRICATION

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connection to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.

C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.

D. Welding of parts shall be in accordance with the Standard Code of Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the County. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.

F. All aluminum finish exposed surfaces, except as specified below, shall have manufacturer's standard mill finish. Aluminum handrails shall be given an anodic oxide treatment in accordance with the Aluminum Association Specification AA-C22-A41. A coating of methacrylate lacquer shall be applied to all aluminum shipment from the factory.

G. Castings shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the County. All finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the

theoretical weight computed from the dimensions shown. The Contractor shall provide facilities for weighing castings in the presence of the County showing true weights, certified by the supplier.

H. All steel finish work shall be thoroughly cleaned, in accordance with the Contract Documents, of all loose mill scale, rust, and foreign matter before shipment and shall be given one shop coat of primer compatible with finish coats specified in Painting Section after fabrication but before shipping. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces. Abrasions in the field shall be touched up with primer immediately after erection. Final painting is specified in the Contract Documents.

I. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the bath until their temperature becomes the same as the bath. Coating shall be not less than 2 oz. per sq. ft. of surface.

3.02 INSTALLATION

A. Install all furnished items imbedded in concrete or other masonry. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.

B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation or provide a 1/32-inch neoprene gasket between the steel surface and the concrete or masonry.

C. Where aluminum is embedded in concrete, apply a heavy coat of approved bitumastic troweling mastic in accordance with the manufacturer's instructions prior to installation.

D. Where aluminum contacts masonry or concrete, provide a 1/32-inch neoprene gasket between the aluminum and the concrete or masonry.

E. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer and provide a 1/32-inch neoprene gasket between the aluminum and the dissimilar metal.

Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

END OF SECTION

SECTION 05530 ALUMINUM GRATING, STAIRS AND PLATFORMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnishing aluminum grating, stairs, platforms and components.

B. Design, including signed and sealed working drawings.

C. Installation.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes.

B. AWS D1.2 - Structural Welding Code - Aluminum.

C. NAAMM - Metal Stair Manual.

1.03 SUBMITTALS

A. Submit Shop Drawings and product data in accordance with Section 01340. Indicate component details, materials, finishes, connection and joining methods and relationship to adjoining work.

1.04 QUALITY ASSURANCE

A. Aluminum grating, stairs and platforms shall be pre-engineered systems, designed and fabricated by the manufacturer.

B. Design Criteria:

1. Grating: Capable of withstanding a uniform load of 100 pounds per square foot with less than 1/4 inch deflection.
2. Stair Treads: Capable of withstanding a uniform load of 100 pounds per square foot, or a concentrated load of 300 pounds on an area of 4 square inches located in the center of the tread, whichever produces the greater stress.
3. Stairs and Ships Ladders: Capable of withstanding a live load of 100 pounds per square foot. Riser and tread dimensions shall comply with BOCA requirements.
4. Platforms: Capable of withstanding a uniform load of 100 pounds per square foot.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Specification based on Irving Grating manufactured by IKG Industries.

B. Substitutions: Products of equal or better quality, function and performance may be proposed for substitution by following the procedures in Section 01630.

2.02 FLOOR GRATING

A. Grating shall be constructed of straight, parallel bearing bars placed edgewise and joined by straight cross bars. Top edge of bearing bars shall be serrated.

B. Bearing bars shall be punched to receive the cross bars. Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars is not acceptable.

C. Cross bars shall be secured to the bearing bars by a swaging process to prevent turning, twisting or coming loose.

D. Ends of cross bars shall be trimmed flush with outside face of each outside bearing bar. Outside bearing bar shall be punched with "detent" holes, or welded flush to cross bars, to form a permanent lock.

E. Material shall be as follows:

1. Bearing Bars: ASTM B221, Alloy 6063-T6.
2. Cross Bars: ASTM B221, Alloy 6063-T5.

2.03 STAIRS AND SHIPS LADDERS

A. Stairs: Aluminum, open riser.

B. Tread Grating: Same pattern as floor grating, treads shall have aluminum corrugated nosing and end plates drilled to fit stair stringers.

C. Stringers: Structural aluminum channels or tubes sized to withstand design loading.

2.04 PLATFORMS

A. Platforms: Structural aluminum channels and miscellaneous framing members same pattern as floor grating.

2.05 FABRICATION

A. Fabricate grating, stairs and platforms conforming to arrangements indicated on final Shop Drawings. Fabricate complete assemblies including framing, hangers, struts, clips, brackets, bearing plates and other components necessary for the support of grating, stairs and platforms, and as required to anchor and contain the assemblies on supporting structures.

B. Comply with Recommended Voluntary Minimum Standards for Fixed Metal Stairs commercial class in NAAMM Metal Stair Manual.

C. Form exposed work true to line and level with accurate angles and surfaces and straight edges. Ease exposed edges to a radius of approximately 1/32 inch. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing the work.

D. Remove sharp edges or rough areas on exposed traffic surfaces.

E. Weld corners and seams continuously in compliance with AWS D1.2. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners whenever possible. Use flat head (countersunk) screws or bolts for exposed fasteners. Locate joints where least conspicuous.

G. Fabricate and space anchoring devices to provide adequate support for intended use.

H. Preassemble items at place of fabrication to greatest extent possible to minimize field splicing and assembly. Use connections that maintain structural value of joined pieces.

PART 3 EXECUTION

3.01 PREPARATION

A. Supply items to be cast in concrete or embedded in masonry.

3.02 DISSIMILAR MATERIALS

A. When aluminum components come in contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with bituminous paint or by installing a vinyl isolation gasket.

B. When aluminum components come into contact with concrete or mortar, all aluminum surfaces (inside and outside) shall be coated with bituminous paint.

3.03 INSTALLATION

A. Install in accordance with final Shop Drawings and manufacturer's instructions.

B. Erect work plumb, square and level, free from distortion or defects detrimental to appearance or performance.

C. Gratings, stairs and platforms shall be securely anchored and bolted to the framing of the structure. Installed work shall be completely free of play at all joints and connections.

END OF SECTION

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SECTION 05600 METAL BUILDINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the contract, including General Specification as may apply to work specified in this Section.

1.02 SCOPE OF WORK

A. Structure and Roof

Furnish and install an open sided structure and roof over the new gravity belt thickener as indicated on the Drawings, including, but not limited to foundation, floor, anchors, baseplates, columns, beams, braces, and roofing.

B. Electrical

Furnish and install electrical equipment as indicated on the Drawings, including, but not limited to conduits, wiring, lighting, switches, and receptacles.

1.03 COORDINATION

A. The work in this Section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.04 SHOP DRAWINGS AND SAMPLES

A. Detail drawings, as provided for in the Contract Documents, showing sizes of members, method of assembly, anchorage, and connection to other members shall be submitted to the County for approval before fabrication.

B. Samples shall be submitted at the request of the County for concurrent review with Shop Drawings.

PART 2 PRODUCTS

1.01 STRUCTURE AND ROOF

Products shall be the materials and sizes indicated on the Drawings.

2.02 ELECTRICAL

Products shall be as indicated on the Drawings and as specified in Division 16.

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING

A. Building components shall be packaged for shipment and handling to prevent physical and environmental damage.

B. Building components shall be transported to the jobsite using the manufacturer's customary method of shipment.

C. Building components hall be off-loaded in a manner that will prevent damage.

3.02 STORAGE

A. Building components shall not be stored on the ground. All components shall be placed on cribbing, or otherwise stored off the ground.

B. Special provisions, as directed by the manufacturer, shall be made for storage of electrical components.

3.03 INSTALLATION

A. The Contractor shall obtain all building permits.

B. The building shall be constructed in accordance with applicable codes and permits.

C. The Contractor shall coordinate all inspections.

END OF SECTION

DIVISION 9 PAINTING

SECTION 09865 SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steels, as specified herein.

1.02 SUBMITTALS

A. Submit to the County for approval, as provided in the Contract Drawings for shop drawings, manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thickness.

B. Submit representative physical samples of the proposed primers, if required by the County.

PART 2 PRODUCTS

2.01 MATERIALS

A. Submerged Services: Shop primer for ferrous metals which will be subject to splash action or which are specified to be considered submerged service shall be sprayed with one coat of Koppers 654 epoxy Primer or Koppers Inertol Primer 621-FDA, dry film thickness 3.5 to 4.5 mils by Koppers Co., Inc., or equal.

B. Nonsubmerged Services: Shop primer for ferrous metals other than those covered by paragraph 2.01 A shall be sprayed with one coat of Koppers Pug Primer, dry film thickness 3.0 to 4.0 mils by Koppers Co., Inc. or equal.

C. Nonprimed Surfaces: Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the County up to the time of the final acceptance.

D. Compatibility of Coating Systems: Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in the Contract Documents for use in the field and which are recommended for use together.

PART 3 EXECUTION

3.01 APPLICATION

A. Surface Preparation and Priming:

1. Non submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-10. Near White, immediately prior to priming.
2. Surfaces shall be dry and free of dust, oil, grease, dirt, rust, loose mill scale and other foreign material before priming.
3. Shop prime in accordance with approved paint manufacturer's recommendations.
4. Priming shall follow sandblasting before any evidence of corrosion has occurred and within 24 hours.

END OF SECTION

SECTION 09900 PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, tools, materials, equipment, scaffolding or other structures and incidentals necessary to complete this Contract in its entirety.

B. The work includes painting and finishing of all new interior and exterior exposed items above and below grade and surfaces, such as structural steel, miscellaneous metals, ceilings, walls, floors, doors, frames, transoms, roof fans, construction signs, guardrails, posts, fittings, valves, tanks, equipment and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the Schedule of Work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specification as stated herein.

C. The following items shall not be painted:

1. Any code-requiring labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
2. Any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated.
3. Aluminum handrails (except where in contact with concrete) walkways, windows, louvers and grating unless otherwise specified herein.
4. Signs and nameplates.
5. Finish hardware.
6. Chain link fence.
7. Piping buried in the ground or embedded in concrete.
8. Concealed surfaces of pipe or crawl space.
9. Nonferrous metals, unless specifically noted otherwise.
10. Electrical switchgear and motor control centers.
11. Stainless steel angles, tubes, pipe, etc.
12. Products with polished chrome, aluminum, nickel or stainless steel finish.
13. Plastic switch plates and receptacle plates.
14. Flexible couplings, lubricated bearing surfaces, insulation and metal and plastic pipe interior.
15. Sprinkler heads.
16. Lifting chain on cranes and hoists
17. Electrical cable, festooned conductor system, cables, collector pole brackets, etc.

D. All work shall be done in strict accordance with this Specification, the Design Drawings and the painting package, including manufacturer's printed instructions.

E. The Contractor will obtain, at its own expense, all permits, licenses and inspections and shall comply with all laws, codes, ordinances, rules and regulations promulgated by authorities having jurisdiction which may bear on the Work. This compliance will include Federal Public Law 91-596 more commonly known as the "Occupational Safety and Health Act of 1970".

1.02 DEFINITIONS

A. Field Painting is the painting of new or rebuilt items at the job site. Field painting shall be the responsibility of the Contractor.

B. Shop Painting is the painting of new or rebuilt items in the shop prior to delivery to the jobsite.

C. Abbreviations The abbreviations and definitions listed below, when used in this specification, shall have the following meanings:

1. SSPC - Steel Structures Painting Council
2. Exterior - Outside, exposed to weather
3. Interior Dry - Inside, concealed or protected from weather
4. Interior Wet - Inside, subject to immersion services
5. ASTM - American Society of Test Materials
6. NACE - National Association of Corrosion Engineers
7. NSF - National Sanitation Foundation
8. AWWA - American Water Works Association

D. Dry Film Thickness shall be in Mils.

1.03 RESOLUTION OF CONFLICTS

A. It shall be the responsibility of the Contractor to arrange a meeting prior to the start of painting, or flooring installation between the Contractor, the Paint Manufacturer, whose products are to be used, and the County. All aspects of surface preparation, application and coating systems as covered by this Specification will be reviewed at this meeting.

B. Clarification shall be requested promptly from the County when instructions are lacking, conflicts occur in the Specifications, or the procedure seems improper or inappropriate for any reason.

C. Copies of all manufacturer's instructions and recommendations shall be furnished to the County by the Painting Contractor.

D. It shall be the responsibility of the Coating Manufacturer to have their factory representative meet in person with the Contractor and County a minimum of three times during the job as a consultant on surface preparation, mil thickness of coating and proper application of coating unless meeting is determined to be unnecessary by the County.

1.04 SUBMITTALS

A. Contractor shall submit catalog data and cut sheets for the painting system being used if not the TNEMEC materials specified.

B. Samples as detailed in 3.01 B shall be submitted regardless of system being used, showing each color to be used.

C. Hazardous Material Disposal documentation shall be submitted if applicable.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Effective oil and water separators shall be used in all compressed air lines serving spray painting and sandblasting operations to remove oil or moisture from the air before it is used. Separators shall be placed as far as practicable from the compressor.

B. All equipment for application of the paint and the completion of the work shall be furnished by the Contractor in first-class condition and shall comply with recommendations of the paint manufacturer.

C. Contractor will provide free of charge to the County a "Nordson-Mikrotest" or "Positest" dry film thickness gauge for ferrous metal and an OG232 "Tooke" gauge or equal for non-ferrous and cementitious surface, to be used to inspect coatings by the County and Contractor. The gauges may be used by the Contractor and returned each day to the County. County will return gauges to Contractor at completion of job.

2.02 MATERIALS

A. All materials specified herein are manufactured by the TNEMEC Company, Inc., North Kansas City, Missouri. These products are specified to establish standards of quality and are approved for use on this Project.

B. Equivalent materials of other manufacturers may be substituted on approval of the County. Requests for substitution shall include manufacturer's literature for each product giving the name, generic type, descriptive information and evidence of satisfactory past performance and an independent laboratory certification that their product meets the performance criteria of the specified materials.

C. Abrasion - Fed. Test Method Std. No. 141, Method 6192, CS-17 Wheel, 1,000 grams load.

D. Adhesion - Elcometer Adhesion Tester.

E. Exterior Exposure - Exposed at 45 degrees facing the ocean (South Florida Marine Exposure)

F. Hardness - ASTM D3363-74

G. Humidity - ASTM D2247-68

H. Salt Spray (Fog) - ASTM B117-73

I. Substitutions which decrease the total film thickness, change the generic type of coating, or fail to meet the performance criteria of the specified materials shall not be approved. Prime and finish coats of all surfaces shall be furnished by the same manufacturer.

J. All coatings to be shop applied must meet the requirements for volatile organic compounds (VOC) of not more than 3.5 lbs./gallon after thinning.

K. Colors, where not specified, shall be as selected by the County or their Representative.

L. All coatings in contact with potable water need to be NSF Certified in accordance with ANSI/NSF Standard 61.

M. All above ground potable water mains and appurtenances shall be painted safety blue.

PART 3 EXECUTION

3.01 INSPECTION OF SURFACES

A. Before application of the prime coat and each succeeding coat, all surfaces to be coated shall be subject to inspection by the County. Any defects or deficiencies shall be corrected by the Contractor before application of any subsequent coating.

B. Samples of surface preparation and of painting systems shall be furnished by the Contractor to be used as a standard throughout the job, unless omitted by the County.

C. When any appreciable time has elapsed between coatings, previously coated areas shall be carefully inspected by the County, and where, in his opinion, surfaces are damaged or contaminated, they shall be cleaned and recoated at the Contractor's expense. Recoating times of manufacturer's printed instructions shall be adhered to.

D. Coating thickness shall be determined by the use of a properly calibrated "Nordson-Mikrotest" "Positest" Coating Thickness Gauge (or equal) for ferrous metal or an OG232 "Tooke" Paint Inspection gauge (or equal) for non-ferrous and cementitious surfaces. Please note that use of the "Tooke" gauge is classified as a destructive test.

3.02 SURFACE PREPARATION

The surface shall be cleaned as specified for the paint system being used. All cleaning shall be as outlined in the Steel Structures Painting Council's Surface Preparation Specification, unless otherwise noted. If surfaces are subject to contamination, other than mill scale or normal atmospheric rusting, the surfaces shall be pressure washed, and acid or caustic pH residues neutralized, in addition to the specified surface preparation.

3.03 STANDARDS FOR SURFACE PREPARATION

A. Chemical and/or Solvent Cleaning: Remove all grease, oil, salt, acid, alkali, dirt, dust, wax, fat, foreign matter and contaminates, etc. by one of the following methods: steam cleaning, alkaline cleaning, or volatile solvent cleaning.

B. Hand Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to a clean sound substrate by hand chipping, scraping, sanding and wire brushing.

C. Power Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to a clean sound substrate by power tool chipping, descaling, sanding, wire brushing and grinding.

D. Flame Cleaning: Dehydrating and removal of rust, loose mill scale and some light mill scale by use of flame, followed by wire brushing.

E. White Metal Blast Cleaning: Complete removal of all mill scale, rust, rust scale, previous coating, etc., leaving the surface a uniform gray-white color.

F. Commercial Grade Blast Cleaning: Complete removal of all dirt, rust scale, mill scale, foreign matter and previous coating, etc., leaving only shadows and/or streaks caused by rust stain and mill scale oxides. At least 66% of each square inch of surface area is to be free of all visible residues, except slight discoloration.

G. Brush-Off Blast Cleaning: Removal of rust scale, loose mill scale, loose rust and loose coatings, leaving tightly-bonded mill scale, rust and previous coatings. On concrete surfaces, brush-off blast cleaning shall remove all laitance, form oils and solid contaminates. Blasting should be performed sufficiently close to the surface so as to open up surface voids, bugholes, air pockets and other subsurface irregularities, but so as not to expose underlying aggregate.

H. Pickling: Complete removal of rust and mill scale by acid pickling, duplex pickling or electrolytic pickling (may reduce the resistance of the surface to corrosion, if not to be primed immediately).

I. Near-White Blast Cleaning: Removal of all rust scale, mill scale, previous coating, etc., leaving only light stains from rust, mill scale and small specks of previous coating. At least 95% of each square inch of surface area is to be free of all visible residues and the remainder shall be limited to slight discoloration.

J. Power Tool Cleaning to Bare Metal: Complete removal of rust, rust scale, mill scale, foreign matter and previous coatings, etc., to a standard as specified on a Commercial Grade Blast Cleaning (SSPC-SP-6, NACE-3) by means of power tools that will provide the proper degree of cleaning and surface profile.

K. Visual standards "Pictorial Surface Preparation Standards for Painting Steel Surfaces", and the National Association of Corrosion Engineer, "Blasting Cleaning Visual Standards" TM-01-70 and TM-01-75 shall be considered as standards for proper surface preparation.

L. Oil, grease, soil, dust, etc., deposited on the surface preparation that has been completed shall be removed prior to painting according to Solvent Cleaning under this Specification.

M. Weld flux, weld spatter and excessive rust scale shall be removed by Power Tool Cleaning as per these Specifications.

N. All weld seams, sharp protrusions and edges shall be ground smooth prior to surface preparation or application of any coatings.

O. All areas requiring field welding shall be masked off prior to shop coating, unless waived by the County.

P. All areas which require field touch-up after erection, such as welds, burnbacks, and mechanically damaged areas, shall be cleaned by thorough Power Tool as specified in these Specifications.

Q. Touch-up systems will be same as original specification except that approved manufacturer's organic zinc-rich shall be used in lieu of inorganic zinc where this system was originally used. Also strict adherence to manufacturer's complete touch-up recommendations shall be followed. Any questions relative to compatibility of products shall be brought to the County's attention; otherwise, Contractor assumes full responsibility.

3.03 PRETREATMENTS

When specified, the surface shall be pretreated in accordance with the specified pretreatment prior to application of the prime coat of paint.

3.04 STORAGE

Materials shall be delivered to the job site in the original packages with seals unbroken and with legible unmutilated labels attached. Packages shall not be opened until they are inspected by the County and required for use. All painting materials shall be stored in a clean, dry, well-ventilated place, protected from sparks, flame, direct rays of the sun or from excessive heat. Paint susceptible to damage from low temperatures shall be kept in a heated storage space when necessary. The Contractor shall be solely responsible for the protection of the materials stored by himself at the job site. Empty coating cans shall be required to be neatly stacked in an area designated by the County and removed from the job site on a schedule determined by the County. County may request a notarized statement from Contractor detailing all materials used on the Project.

3.05 PREPARATION OF MATERIALS

A. Mechanical mixers, capable of thoroughly mixing the pigment and vehicle together, shall mix the paint prior to use where required by manufacturer's instructions; thorough hand mixing will be allowed for small amounts up to one gallon. Pressure pots shall be equipped with mechanical mixers to keep the pigment in suspension, when required by manufacturer's instructions. Otherwise, intermittent hand mixing shall be done to assure that no separation occurs. All mixing shall be done in accordance with SSPC Vol. 1, Chapter 4, "Practical Aspects, Use and Application of Paints" and/or with manufacturer's recommendations.

B. Catalysts or thinners shall be as recommended by the manufacturer and shall be added or discarded strictly in accordance with the manufacturer's instruction.

3.06 APPLICATION

A. Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather, unless otherwise allowed by the paint manufacturer. Except as provided below, painting shall not be permitted when the atmospheric temperature is below 50° F, or when freshly painted surfaces may be damaged by rain, fog, dust, or condensation, and/or when it can be anticipated that these conditions will prevail during the drying period.

B. No coatings shall be applied unless surface temperature is a minimum of 5deg above dew point; temperature must be maintained during curing.

C. See coating schedule for actual coating systems to be used on this project.

3.07 DEW POINT CALCULATION CHART

DEW POINT CALCULATION CHART

Ambient Air Temperature - Fahrenheit

Relative Humidity	20	30	40	50	60	70	80	90	100	110	120
90%	18	28	37	47	57	67	77	87	97	107	117
85%	17	26	36	45	55	65	76	84	95	104	113
80%	16	25	34	44	54	63	73	82	93	102	110

75%	15	24	33	42	52	62	71	80	91	100	108
70%	13	22	31	40	50	60	68	78	88	96	105
65%	12	20	29	38	47	57	66	76	85	93	103
60%	11	29	27	36	45	55	64	73	83	92	101
55%	9	17	25	34	43	53	61	70	80	89	98
50%	6	15	23	31	40	50	59	67	77	86	94
45%	4	13	21	29	37	47	56	64	73	82	91
40%	1	11	18	26	35	43	52	61	69	78	87
35%	-2	8	16	23	31	40	48	57	65	74	83

SURFACE TEMPERATURE AT WHICH CONDENSATION OCCURS

Dew Point

Temperature at which moisture will condense on surface. No coatings should be applied unless surface temperature is a minimum of 5° above this point. Temperature must be maintained during curing.

Example

If air temperature is 70° F and relative humidity is 65%, the dew point is 57° F. No coating should be applied unless surface temperature is 62° F minimum.

A. No coating shall be applied unless the relative humidity is below 85%.

B. Suitable enclosures to permit painting during inclement weather may be used if provisions are made to control atmospheric conditions artificially inside the enclosure, within limits suitable for painting throughout the painting operations.

C. Field painting in the immediate vicinity of, or on, energized electrical and rotating equipment, and equipment and/or pipes in service shall not be performed without the approval of the County.

D. Extreme care shall be exercised in the painting of all operable equipment, such as valves, electric motors, etc., so that the proper functioning of the equipment will not be affected.

E. The Contractor's scaffolding shall be erected, maintained and dismantled without damage to structures, machinery, equipment or pipe. Drop cloths shall be used where required to protect buildings and equipment. All surfaces required to be clear for visual observation shall be cleaned immediately after paint application.

F. Painting shall not be performed on insulated pipe within three (3) feet of insulation operations or on insulation whose covering and surface coat have not had time to set and dry. Painting shall not be performed on uninsulated pipe within one (1) foot of any type of connection until the connection has been made, except as directed by the County.

G. The prime coat shall be applied immediately following surface preparation and in no case later than the same working day. All paint shall be applied by brushing, paint mitt and roller, conventional spraying, or airless spraying, using equipment approved by the paint manufacturer.

H. Each coat of paint shall be recoated as per manufacturer's instructions. Paint shall be

considered recoatable when an additional coat can be applied without any detrimental film irregularities such as lifting or loss of adhesion.

I. Surfaces that will be inaccessible after assembly shall receive either the full specified paint system or three shop coats of the specified primer before assembly.

J. Finish colors shall be in accordance with the COLOR SCHEDULE and shall be factory mixed (i.e., there shall be no tinting by the Contractor, unless authorized by the County).

K. All edges and weld seams in immersion service shall receive a "stripe coat" (applied by brush) of the 2nd coat prior to application of the full 2nd coat.

L. All open seams in the roof area of tanks shall be filled after application of the topcoat with a flexible caulking such as Sika Flex 1A.

3.08 WORKMANSHIP

A. The Contractor must show proof that all employees associated with this Project shall have been employed by the Contractor for a period not less than six (6) months.

B. Painting shall be performed by experienced painters in accordance with the recommendations of the paint manufacturer. All paint shall be uniformly applied without sags, runs, spots, or other blemishes. Work which shows carelessness, lack of skill, or is defective in the opinion of the County, shall be corrected at the expense of the Contractor.

C. The Contractor shall provide the names of at least three other projects of similar size and scope that they have successfully completed under their current company name.

3.09 APPLICATION OF PAINT

A. By Brush and/or Rollers

1. Top quality, properly styled brushes and rollers shall be used. Rollers with a baked phenol core shall be utilized.
2. The brushing or rolling shall be done so that a smooth coat as nearly uniform in thickness as possible is obtained. Brush or roller strokes shall be made to smooth the film without leaving deep or detrimental marks.
3. Surfaces not accessible to brushes or rollers may be painted by spray, by dauber or sheepskins, and paint mitt.
4. It may require two coats to achieve the specified dry film thickness if application is by brush and roller.

B. Air, Airless or Hot Spray

1. The equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied and shall be equipped with suitable pressure regulators and gauges.
2. Paint shall be applied in a uniform layer, with a 50% overlap pattern. All runs and sags should be brushed out immediately or the paint shall be removed and the surface resprayed.
3. High build coatings should be applied by a cross-hatch method of spray application to ensure proper film thickness of the coating.
4. Areas inaccessible to spray shall be brushed; if also inaccessible to brush, daubs

or sheepskins shall be used, as authorized by the manufacturer.

5. Special care shall be taken with thinners and paint temperatures so that paint of the correct formula reaches the receiving surface.
6. Nozzles, tips, etc., shall be of sizes and designs as recommended by the manufacturer of the paint being sprayed.
7. The first coat on concrete surfaces in immersion service should be sprayed and back rolled.

3.10 PROTECTION AND CLEANUP

A. It shall be the responsibility of the Contractor to protect at all times, in areas where painting is being done, floors, materials of other crafts, equipment, vehicles, fixtures, and finished surfaces adjacent to paint work. Cover all electric plates, surface hardware, nameplates, gauge glasses, etc., before start of painting work.

B. At the option of the County during the course of this project, the Contractor will contain all spent abrasives, old paint chips, paint overspray and debris by means suitable to the County, including, but not limited to, full shrouding of the area.

C. If shrouding is required, the Contractor must provide a complete design of the intended shroud or cover. Care must be taken not to modify or damage the structure during the use of the shroud. If damage should occur, the Contractor is held responsible for all repairs.

D. At completion of the work, remove all paint where spilled, splashed, spattered, sprayed or smeared on all surfaces, including glass, light fixtures, hardware, equipment, painted and unpainted surfaces.

E. After completion of all painting, the Contractor shall remove from job site all painting equipment, surplus materials and debris resulting from this work.

F. The Contractor is responsible for the removal and proper disposal of all hazardous materials from the job site in accordance with Local, State and Federal requirements as outlined by the Environmental Protection Agency.

G. A notarized statement shall be presented to the County that all hazardous materials have been disposed of properly including, but not limited to: name of disposal company, disposal site, listing of hazardous materials, weights of all materials, cost per pound and EPA registration number.

3.11 TOUCH-UP MATERIALS

The Contractor shall provide at the end of the Project at least one (1) gallon of each generic topcoat in each color as specified by the County for future touch-up. Two gallons may be required for (2) component materials.

3.12 ON-SITE INSPECTION

During the course of this Project, the County will reserve the option of incorporating the services of a qualified inspection service. The inspection service will be responsible for assuring the proper execution of this Specification by the successful Contractor.

3.13 STEEL - STRUCTURAL, TANKS, PIPES AND EQUIPMENT

A. EXTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 73-1: Epoxy/High Build Urethane

This system is highly resistant to abrasion, wet conditions, corrosive fumes and chemical contact. Provides 3-4 times the color and gloss retention of conventional paints. Second coat to be same color or close to finish color. Specify Series 74 Endura-Shield for gloss finish.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 66-1211 Epoxoline Primer	3.0 - 4.0
2nd Coat: 66-Color Hi-Build Epoxoline	2.0 - 3.0
3rd Coat: 73-Endura-Shield III	2.0 - 3.0
Dry Film Thickness	7.0 - 10.0
Minimum	8.0 Mils

2. System No. 73-2: High Build Urethane for Marginally Cleaned Surfaces or Topcoating Existing System

This system can be used over factory finish paint or cover non-sandblasted steel and offer the high performance of a urethane coating. Specify Series 74 Endura-Shield for gloss finish.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning or SSPC-SP3 Power Tool Cleaning

Shop Coat: Manufacturer Standard Primer (or existing coating)	1.5 - 2.0
2nd Coat: 135 Chembuild	3.0 - 5.0
3rd Coat: 73-Color Endura-Shield	2.0 - 3.0
Dry Film Thickness	6.5 - 10.0
Minimum	7.5 Mils

3. System No. 82-1: Silicone Alkyd Enamel - Gloss

Coating system for outstanding color and gloss retention and weatherability. This system will provide better performance than alkyd enamel, but not as good as a urethane. Series 82 includes a minimum of 30% silicone resin and conforms to SSPC-Paint 21-78, Type 1.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 37H-77 Chem Prime	2.0 - 3.5
2nd Coat: 23-Color Enduratone	2.0 - 3.0
3rd Coat: 82-Color Silicone Alkyd Enamel	1.0 - 2.0
Dry Film Thickness	5.0 - 8.5
Minimum	6.0 Mils

4. System 90-97: Zinc/Epoxy/Urethane

This system offers the added corrosion protection of a zinc rich primer. Series 90-

97 Tneme-Zinc is an organic zinc-rich primer that can be used for field touch up of a zinc primer or for touch up of galvanized surfaces that are damaged.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 90-97 Tneme-Zinc	2.5 - 3.5
2nd Coat: 66-Color Hi-Build Epoxoline	2.0 - 3.0
3rd Coat: 73 Endurashield III	2.0 - 3.0
Dry Film Thickness	6.5 - 9.5
Minimum	8.0 Mils

B. INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 69.1: High Solids Epoxy

This coating will provide maximum protection. It offers chemical and corrosion resistance for long-term protection against salt spray, moisture, corrosive fumes, and chemical attack. Series 69 is a polyamidoamine cured epoxy. Primer coat must be touched-up before second coat is applied.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 69-1211 Epoxoline Primer II	3.0 - 5.0
2nd Coat:	
69-Color Hi-Build Expoxoline II	4.0 - 6.0
Dry Film Thickness	7.0 - 11.0
Minimum	9.0 Mils

2. System No.66-2: High Build Epoxy

This system will provide chemical and corrosion resistance against abrasion, moisture, corrosion fumes, chemical contact and immersion in non-potable water. Primer coat must be touched-up before second coat is applied. Substitute Series 161 for low temperature cure or quick recoats.

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Shop Coat: 69-1211 Epoxoline Primer	3.0 - 5.0
2nd Coat: 69-Color Hi-Build Expoxoline	4.0 - 6.0
Dry Film Thickness	7.0 - 11.0
Minimum	9.0 Mils

3. System No. 66-6: High Build Epoxy (Over OEM Finishes)

This system is to be used over standard manufacturer's primer to offer a high performance epoxy finish. Excellent for areas of rust not able to be completely cleaned.

Surface Preparation: Spot SSPC-SP6 Commercial Blast Cleaning or SSPC- SP11 Power Tool Cleaning to Bare Metal

Shop Coat: Manufacturer's Standard (or existing coating)	1.0 - 2.0

2nd Coat: 50-330 Poly-Ura-Prime 2.0 - 3.0
3rd Coat: 66-Color Hi-Build Expoxoline 2.0 - 4.0
Dry Film Thickness 5.0 - 9.0
Minimum 7.0 Mils

C. IMMERSION

1. System No. 69-2: High Solids Epoxy (Non-Potable Water)

This system provides maximum protection in immersion service. Scarify the surface before topcoating if the Series 69 has been exterior-exposed for 90 days or longer. If primer coat is damaged, it must be touched-up before second coat is applied.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat:
69-1211 Hi-Build Epoxoline II 3.0 - 5.0
2nd Coat:
69-Color Hi-Build Expoxoline II 6.0 - 8.0
Dry Film Thickness 9.0 - 13.0
Minimum 11.0 Mils

2. System No. 66-2: High Solids Epoxy (Non-Potable Water)

This system will provide chemical and corrosion resistance for protection against abrasion, moisture, corrosive fumes, chemical contact and immersion. Primer coat must be touched-up before second coat is applied. Scarify the surface before topcoating if the Series 66 has been exterior-exposed for 60 days or longer. Substitute Series 161 for low temperature cure or quick recoats.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat: 66-1211 Epoxoline Primer 3.0 - 5.0
2nd Coat: 66-Color Hi-Build Expoxoline 3.0 - 5.0
3rd Coat: 66-Color Hi-Build Expoxoline 3.0 - 5.0
Dry Film Thickness 9.0 - 15.0
Minimum 11.0 Mils

3. System No. 20-1: Epoxy-Polyamide (Potable Water)

This system meets American Water Works Association AWWA D 102 Inside Paint System Number 1. Series 20 meets the new requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61. Substitute Series FC20 for low temperature cure or quick recoats.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat:
20-WH02 Pota-Pox (Tank White) 3.0 - 5.0
2nd Coat: 20-1255 Pota-Pox (Beige) 4.0 - 6.0
3rd Coat: 20-WH02 Pota-Pox (Tank White) 4.0 - 6.0
Dry Film Thickness 11.0 - 17.0

Minimum 12.0 Mils

4. System No. 140: High Solids Epoxy (Potable Water)

Series 140 meets the new requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

Shop Coat: 140-1255 Pota-Pox II (Beige) 6.0 - 8.0
2nd Coat:
140-WH02 Pota-Pox II (Tank White) 6.0 - 8.0
Dry Film Thickness 12.0 - 16.0
Minimum 14.0 Mils

5. System No. 46-30: Coal Tar-Epoxy (Non-Potable Water Only)

May be applied in a two-coat application. Review critical recoat time if utilized.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning*

One Coat: 46H-413 Hi-Build Tneme Tar
Minimum Dry Film Thickness 14.0 - 20.0

*SSPC-SP-6 Commercial Blast Cleaning may be used for non-immersion service.

6. System No. 46-26: Coal Tar Epoxy (Non-Potable Water Only)

Must be recoated within four days at 75deg F. Higher temperature will shorten recoat time.

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning*

1st Coat: 46-413 Tneme Tar 8.0 - 10.0
2nd Coat: 46-413 Tneme Tar 8.0 - 10.0
Dry Film Thickness 16.0 - 20.0
Minimum 16.0 Mils

*SSPC-6 Commercial Blast Cleaning may be used for non-immersion service.

3.14 OVERHEAD METAL DECKING, JOIST

A. INTERIOR EXPOSURE

System No. 15-1: Uni-Bond

This system should be used on ceiling areas where a one-coat system is desired. Can be applied over steel, galvanized and aluminum decking, joist, beams, conduits and concrete.

Surface Preparation: Surfaces must be dry, clean and free of oil, grease and other contaminates. Allow concrete to cure 28 days.

Coating: 15-Color Uni-Bond

Dry Film Thickness 2.5 - 3.5

B. EXTERIOR EXPOSURE

System No. 135-1: Chembuild

This system can be applied over a wide variety of coatings and factory finishes. It can also be applied direct to galvanized aluminum decking, joists, conduits and tight rust.

Surface Preparation: Pressure clean to remove all dirt, oil, grease, chemicals and foreign contaminates. Remove loose paint and all rust by hand and power tool cleaning (SSPC-SP 2 & 3)

Coating: 135-Color Chembuild

Dry Film Thickness 3.0 - 5.0

3.15 MILL COATED STEEL PIPE

A. EXTERIOR/INTERIOR EXPOSURE (NON-IMMERSION)

System No. 66-3: Epoxy-Polyamide

This system can be applied directly to mill coated steel pipe without sandblasting for use in non-immersion. There may be some bleed through with the 1st coat. Do not apply over glossy varnish type mill coatings.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 66-1211 Epoxoline Primer	3.0 - 4.0
2nd Coat: 66-Color Hi-Build Expoxoline	4.0 - 6.0
3rd Coat: (If required)	(4.0 - 6.0)
Dry Film Thickness	11.0 - 16.0
Minimum	11.0 Mils

3.16 GALVANIZED STEEL - PIPE AND MISCELLANEOUS FABRICATIONS

A. EXTERIOR / (NON-IMMERSION)

System No. 73-1: Epoxy/High Build Urethane

Series 66 has excellent adhesion to galvanized steel. This system is highly resistant to abrasion, wet conditions, corrosive fumes and chemical contact. Provides 3-4 times the color and gloss retention of conventional paints. First coat to be same color as or close to the finish color. Specify Series 74 Endura-Shield for gloss finish.

Surface Preparation: SSPC-SP1 Solvent Cleaning

1st Coat: 66-Color Hi-Build Epoxoline	2.0 - 4.0
2nd Coat: 73-Color Endura-Shield	2.0 - 4.0
Dry Film Thickness	4.0 - 8.0
Minimum	5.0 Mils

B. INTERIOR EXPOSURE (NON IMMERSION) AND ALUMINUM IN CONTACT WITH CONCRETE

System No. 66-6: Polyamide Epoxy

Surface Preparation: SSPC-SP1 Solvent Cleaning

1st Coat: 66-Color Hi-Build Epoxoline	2.0 - 4.0
2nd Coat: 66-Color Hi-Build Epoxoline	2.0 - 4.0
Dry Film Thickness	4.0 - 8.0
Minimum	5.0 Mils

C. IMMERSION (POTABLE WATER)

System No. 20-1: Epoxy-Polyamide (Potable Water)

Series 20 meets the new requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61. Substitute Series FC20 for low temperature cure of quick recoat.

Surface Preparation: SSPC-SP 7 Brush Off Blast Cleaning

1st Coat: 20-1255 Pota-Pox Primer	3.0 - 5.0
2nd Coat: 20-WH02 Pota-Pox Finish	4.0 - 6.0
Dry Film Thickness	7.0 -11.0
Minimum	9.0 Mils

3.17 CHAIN-LINK FENCES

A. GALVANIZED STEEL & NON-FERROUS METAL

System No. 22-1: Oil-Cementitious

Surface Preparation: Surface shall be clean and dry

One Coat: 22-Color Galv-Gard

Dry Film Thickness 3.0 - 4.0

3.18 CONCRETE

A. EXTERIOR - ABOVE GRADE

1. System No. 52-1 Modified Epoxy - Sand Texture

Series 52 is a high build, decorative sand texture finish that hides minor surface irregularities and gives long-term protection against weather, driving rain, ultraviolet exposure, alternate freezing and thawing. Series 52 will actually become part of the concrete. Available in Series 55, Tneme-Crete smooth finish. For porous substrates, a second coat of Series 52 is required. Substitute Series 180 or 181 W.B. Tneme-Crete when specified over existing acrylic or latex coatings.

Surface Preparation: Surface shall be clean and dry.

One Coat: 52-Color Tneme-Crete

Dry Film Thickness 8.0 - 10.0

2. System No. 6-1: Acrylic Emulsion Low Sheen

If semi-gloss finish is desired, use Series 7 Tneme-Cryl SG as the second coat.

Surface Preparation: Surface must be clean and dry.

1st Coat: 6-Color Tneme-Cryl	2.0 - 3.0	
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0	
	Dry Film Thickness	4.0 - 6.0
	Minimum	5.0 Mils

3. System No. 156-1: Modified Acrylic Elastomer

If texture is needed, use 157 Enviro-Crete TX (medium texture) or 159 Enviro-Crete XTX (coarse texture). For application over previously applied coatings, use TNEMEC Series 151 Elasto-Grip at 1.0 - 2.5 mils DFT prior to the application of Series 156 Enviro-Crete.

Surface Preparation: Surface must be clean and dry.

1st Coat: 156-Color Enviro-Crete	4.0 - 8.0	
2nd Coat: 156-Color Enviro-Crete	4.0 - 8.0	
	Dry Film Thickness	8.0 - 16.0
	Minimum	10.0 Mils

B. EXTERIOR - BELOW GRADE

1. System No. 46-61: Coal Tar Pitch Solution

Surface Preparation: Surface must be clean and dry, Level all protrusions.

1st Coat: 46-465 H.B. Tnemecol	8.0 - 12.0	
2nd Coat: 46-465 H.B. Tnemecol	8.0 - 12.0	
	Dry Film Thickness	16.0 - 24.0
	Minimum	16.0 Mils

2. System No. 46-31: Coal Tar-Epoxy

Surface Preparation: Surface shall be clean and dry.

One Coat: 46H-413 Hi-Build Tneme-Tar

Dry Film Thickness 14.0 - 20.0

3. System No. 100-1: Crystaline Waterproofing

This system can be applied to concrete that is still wet or has not developed final cure. It can be used where wet surface conditions exist or where there is the potential for water intrusion due to hydrostatic pressure. Application shall be per Xypex specification manual.

Surface Preparation: Surface to be clean and roughened by Brush Blasting or Acid Etching.

1st Coat: XYPEX Concentrate at 1.5 lbs./SY
2nd Coat: XYPEX Modified at 1.5 lbs./SY

C. EXTERIOR/INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 6-1: Acrylic Emulsion, Low Sheen (Interior/Exterior)

This system will provide a decorative coating with good exterior durability, color retention, and a high vapor transmission rate. For Semi-Gloss finish, use 7-Color Tneme-Cryl S/G.

Surface Preparation: Surface shall be clean and dry. Allow concrete to cure for 28 days.

1st Coat: 6-Color Tneme-Cryl	2.0 - 3.0	
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0	
	Dry Film Thickness	4.0 - 6.0
	Minimum	5.0 Mils

2. System No. 66-4: Epoxy-Polyamide (Interior/Exterior)

Series 66 provides excellent protection from abrasion, moisture, corrosive fumes and chemical contact. For exterior exposures, topcoat with Series 73, or 74 Endura-Tone for gloss and color retention.

Surface Preparation: Surfaces shall be clean and dry. Allow concrete to cure for 28 days. SSPC-SP-7 Brush-Off Blast Clean.

1st Coat: 66-Color Hi-Build Epoxoline	3.0 - 5.0	
2nd Coat: 66-Color Hi-Build Epoxoline	4.0 - 6.0	
	Dry Film Thickness	7.0 -11.0
	Minimum	9.0 Mils

3. System No. 83-1: High Solids Catalyzed Epoxy (Interior)

Surface Preparation: Surface shall be clean and dry. Allow concrete to cure for 28 days. SSPC-SP-7 Brush Off Blast Clean. Concrete block surfaces: Allow to cure 28 days. Level fins, protrusions and mortar splatter.

1st Coat: 83-Color Ceramlon II	6.0 - 10.0	
2nd Coat: 83-Color Ceramlon II	6.0 - 10.0	
	Dry Film Thickness	12.0 - 20.0
	Minimum	14.0 Mils

D. IMMERSION - POTABLE & NON-POTABLE WATER

1. System No. 66-4: Epoxy Polyamide (Non-Potable Water)

Surface irregularities and bug holes should be filled to a smooth uniform appearance as required with TNEMEC Series 63-1500 Filler and Surfacer.

Surface Preparation: SSPC-SP-7 Brush-Off Blast Cleaning

1st Coat: 66-Color Hi-Build Epoxoline	4.0 - 6.0
2nd Coat: 66-Color Hi-Build Epoxoline	4.0 - 6.0
Dry Film Thickness	8.0 -12.0
Minimum	10.0 Mils

2. System No. 104-5: High Solids Epoxy (Non-Potable Water)

Surface irregularities and bug holes should be filled to a smooth uniform appearance as required with TNEMEC Series 63-1500 Filler and Surfacer.

Surface Preparation: SSPC-SP-7 Brush-Off Blast Cleaning

1st Coat: 104-1255 H.S. Epoxy Primer	6.0 - 10.0
2nd Coat: 104 Color H.S. Epoxy	6.0 - 10.0
Dry Film Thickness	12.0 - 20.0
Minimum	14.0 Mils

3. System No. 46-31: Coal Tar-Epoxy (Non-Potable Water)

May be applied in a two-coat application. Review critical recoat time is utilized. Surface irregularities and bugholes should be filled to a smooth uniform appearance as required with TNEMEC Series 63-1500 Filler and Surfacer.

Surface Preparation: Brush-Off Blast Cleaning

One Coat: 46H-413 Hi-Build Tneme-Tar

Dry Film Thickness	14.0-20.0

4. System No. 45-27: Coal Tar Epoxy (Non-Potable Only)

Must be recoated within four days at 75deg F. Higher temperature will shorten recoat time.

Surface Preparation: Brush-Off Blast Cleaning

1st Coat: 46-413 Tneme Tar	8.0 - 10.0
2nd Coat: 46-413 Tneme Tar	8.0 - 10.0
Dry Film Thickness	16.0 - 20.0
Minimum	16.0 Mils

5. System No. 20-2 Epoxy-Polyamide (Potable Water)

This system meets American Water Works Association AWWA D 102 Inside System No. 1. Series 20 meets the new requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61. Surface irregularities and bug holes should be filled to a smooth uniform appearance as required with TNEMEC Series 63-1500 Filler and Surfacer. (NSF Standard 61 approved). Substitute Series FC20 for low temperature cure or quick

recoats.

Surface Preparation: SSPC-SP10 Near White Blast Cleaning

1st Coat: 20-1255 Pota-Pox	4.0 - 6.0	
2nd Coat: 20-WH02 Pota-Pox Finish	4.0 - 6.0	
	Dry Film Thickness	8.0 - 12.0
	Minimum	10.0 Mils

6. System No. 139-2: Epoxy-Polyamine (Potable Water)

Series 139 meets the new requirements of approval for potable water use as established by the National Sanitation Foundation Standard 61. Surface irregularities and bug holes should be filled to a smooth uniform appearance as required with TNEMEC Series 63-1500 Filler and Surfacer. (NSF Standard 61 approved.)

Surface Preparation: SSPC-SP10 Near-White Blast Cleaning

1st Coat: 139-1255 Pota-Pox II	6.0 - 8.0	
2nd Coat: 139-WH02 Pota-Pox II	6.0 - 8.0	
	Dry Film Thickness	12.0 - 16.0
	Minimum	14.0 Mils

E. INTERIOR EXPOSURE (NON-IMMERSION)

1. System No. 104-3: High Solids Expoxy

This system will produce a slick, tile-like finish that has excellent chemical and water resistance. Surface will be easy to clean.

Surface Preparation: Surface to be clean and dry.

1st Coat: 104-Color H.S. Epoxy	6.0 - 8.0	
2nd Coat: 104-Color H.S. Epoxy	6.0 - 8.0	
	Dry Film Thickness	12.0 - 16.0
	Minimum	14.0 Mils

2. System No. 113-1: Acrylic-Epoxy Semi-Gloss

This system will provide high performance and can be applied directly over existing coatings without lifting. Can be used when low odor is required during application. Specify Series 114 Tneme-Tuffcoat for Gloss Finish.

Surface Preparation: Surface must be clean and dry.

One Coat: 113-Color Tneme-Tuffcoat

Dry Film Thickness	4.0 - 6.0

3.19 CONCRETE FLOORS

A. EPOXY FLOOR COATINGS

1. System No. 67-1: Epoxy-Polyamide

This system will provide a durable, long-wearing coating that bonds tightly to concrete and stands up under heavy foot traffic, frequent cleaning and spillage of water, oil, grease, or chemical.

Surface Preparation: Acid Etch or Brush-Off Blast Cleaning

1st Coat: 67-Color Tnema-Tread	2.0 - 3.0
2nd Coat: 67-Color Tnema-Tread	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

2. System No. S67-1: Epoxy-Polyamide (Non-Skid)

This system will provide the same protection and durability as System 67-1 with the addition of a non-skid finish.

Surface Preparation: Acid Etch or Brush-Off Blast Cleaning

1st Coat: S67-Color Tneme-Tread	2.0 - 3.0
2nd Coat: 67-Color Tneme-Tread	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

3. System No. 73-12: Epoxy/Urethane

This system will provide maximum protection against chemical splash and spillage, wet conditions and abrasion. Specify Series 70 Endura-Shield for Gloss finish. First coat must be thinned 20% prior to application. For non-skid finish, specify Series S67 Tneme-Tread for the first and second coat.

Surface Preparation: Acid Etch or Brush-Off Blast Cleaning

1st Coat: 67-Color Tneme-Tread	2.0 - 3.0
2nd Coat: 67-Color Tneme-Tread	2.0 - 3.0
3rd Coat: 71-Color Endura-Shield	1.5 - 2.5
Dry Film Thickness	5.5 - 8.5
Minimum	6.5 Mils

4. System No. 281-1: High Build Polyamine-Epoxy Floor

Please refer to manufacturer's Installation Guide and Technical Data for proper installation.

Surface Preparation: Abrasive blast cleaning (refer to Installation Guide of manufacturer.

1st Coat: 201 Epoxoprime	6.0 - 8.0
2nd Coat: 281 Tneme-Glaze	6.0 - 8.0
Dry Film Thickness	12.0 - 16.0
Minimum	14.0 Mils

5. System No. 221/281: Functional Flooring (Non-Slip)

Please refer to manufacturer's Installation Guide and Technical Data for proper installation.

Surface Preparation: Abrasive blast cleaning (refer to Installation Guide of manufacturer.

1st Coat: 201 Epoxoprime	6.0 - 8.0
2nd Coat: 221 Lami-Tread (2 cts. @ 1/16" ea.)	1/8"
3rd Coat: 281 Tneme-Glaze	8.0 - 12.0
	Minimum Dry Film Thickness 1/4"+

3.20 POROUS MASONRY

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 52-2: Modified Epoxy - Sand Texture

First coat of Tneme-Crete will act as a filler coat while the second coat will completely seal and finish. Long-term life and high performance. Available in Series 55 Tneme-Crete smooth finish.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 52-Color Tneme-Crete 60 - 80 SF
2nd Coat: 52-Color Tneme-Crete Per Gal/Per Coat

2. System No. 6-2: Acrylic Emulsion, Low Sheen

This system will fill the block and provide a sealed surface. For Semi-Gloss Finish, use 7-Color Tneme-Cryl S/G.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 54-562 Modified Epoxy Masonry Filler

	80 SF Gal
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0
3rd Coat: 6-Color Tneme-Cryl	2.0 - 3.0
	*4.0 - 6.0

*Total Dry Film Thickness of Topcoats Only.

3. System No. 66-15: Epoxy-Polyamide (Interior)

Block Filler is a modified epoxy designed for high moisture.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 54-660 Epoxy Masonry Filler	100 SF/Gal
2nd Coat: 66-Color Hi-Build Epoxoline	4.0 - 6.0
3rd Coat: 66-Color Hi-Build Epoxoline	4.0 - 6.0

*8.0 - 12.0

*Total Dry Film Thickness of Topcoats Only.

4. System No. 104-6: High Solids Epoxy (Interior Only)

This system will produce a film thickness of 16 mils. The surface will be tile-like for easy cleaning and will provide protection against chemical attack, corrosive fumes, high humidity and wash down. Backfold first coat to fill porosity.

Surface Preparation: Surface to be clean and dry.

1st Coat: 104-Color H.S. Epoxy	6.0 - 10.0
2nd Coat: 104-Color H.S. Epoxy	6.0 - 10.0
Dry Film Thickness	12.0 - 20.0
Minimum	14.0 Mils

5. System No. 113-1: Acrylic-Epoxy Semi-Gloss (Interior Only)

Series 113 Tneme-Tufcoat has very low odor and can be used when painting in occupied areas. Specify Series 114 Tneme-Tufcoat for a gloss finish.

Surface Preparation: Surface must be clean and dry.

1st Coat: 130 Envirofill	100 SF/Gal
2nd Coat: 113-Color Tnema-Tufcoat*	4.0 - 6.0
	**4.0 - 6.0

* Two coats may be required if applied by roller
** Total Dry Film Thickness of Topcoats Only

6. System No. 156-1: Modified Acrylic Elastomer

If texture is needed, use 157 Enviro-Crete TX (medium texture of 159 Enviro-Crete XTX - coarse texture). For application over previously applied coatings, use TNEMEC 151 Elasto-Grip at 1.0 - 2.5 mils DFT.

Surface Preparation: Surfaces must be clean and dry.

1st Coat: 130 Envirofil	100 SF/Gal
2nd Coat: 156-Color Enviro-Crete	4.0 - 8.0
3rd Coat: 156-Color Enviro-Crete	4.0 - 8.0
Dry Film Thickness	8.0 - 16.0
Minimum	10.0 Mils
	(For 2nd & 3rd Coats)

3.21 GYPSUM WALLBOARD

A. INTERIOR EXPOSURE

1. System No. 111-5: Acrylic-Epoxy

Surface Preparation: Surface must be clean and dry.

1st Coat: 51-792 PVA Sealer	1.0 - 2.0
2nd Coat: 113 H.B. Tnemetufcoat*	4.0 - 5.0
Dry Film Thickness	5.0 - 7.0
Minimum	6.0 Mils

*Two coats may be required if application is by brush and roller.

2. System No. 66-22: Hi-Build Epoxoline

Surface Preparation: Surface must be clean and dry.

1st Coat: 51-792 PVA Sealer	1.0 - 2.0
2nd Coat: 66-Color Hi-Build Epoxoline*	4.0 - 6.0
Dry Film Thickness	5.0 - 8.0
Minimum	5.0 Mils

*Two coats may be required if applied by roller

3. System No. 6-1: Acrylic Emulsion, Low Sheen (Interior/Exterior Exposure)

This system is designed for mild use areas like office walls, laboratory ceilings, stairwells, etc. For Semi-Gloss finish, use 7-color Tneme-Cryl S/G.

Surface Preparation: Surface must be dry and clean.

1st Coat: 6-Color Tneme-Cryl	2.0 - 3.0
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

3.22 WOOD

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 23-4: Alkyd Semi-Gloss

Specify Series 2H Hi-Build Tneme-Gloss for High Gloss finish.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 36-603 Undercoater	2.5 - 3.5
2nd Coat: 23 Enduratone	1.5 - 3.5
3rd Coat: 23 Enduratone	1.5 - 3.5
Dry Film Thickness	5.5 - 10.5
Minimum	6.0 Mils

2. System No. 6-5: Acrylic Latex

Substitute Series 7 if semi-gloss finish is desired.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 36-603 Undercoater	2.0 - 3.5
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0
3rd Coat: 6-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	6.0 - 9.5
Minimum	7.5 Mils

3.23 PVC PIPE

A. EXTERIOR OR INTERIOR

System No. 66-23: Epoxy-Polyamide

Optional topcoat of Series 73/74 Endura-Shield would give long-term color and gloss retention for exterior exposure.

Surface Preparation: Surface shall be clean and dry.

One Coat: 66-Color Hi-Build Epoxoline

Dry Film Thickness	4.0 - 6.0

3.24 INSULATED PIPE

A. INTERIOR EXPOSURE

System No. 6-1: Acrylic Emulsion, Low Sheen

For semi-gloss finish, use 7-Color Tneme-Cryl S/G.

Surface Preparation: Surface shall be clean and dry.

1st Coat: 6-Color Tneme-Cryl	2.0 - 3.0
2nd Coat: 6-Color Tneme-Cryl	2.0 - 3.0
Dry Film Thickness	4.0 - 6.0
Minimum	5.0 Mils

3.25 HIGH HEAT COATING

A. EXTERIOR/INTERIOR EXPOSURE

1. System No. 39-2: Silicone Aluminum (1200deg F Maximum)

   Surface Preparation: SSPC-SP10 Near-White Blast Cleaning - 1.0 Mil Surface Profile

1st Coat: 39-1261 Silicone Aluminum	1.0 - 1.5
2nd Coat: 39-1261 Silicone Aluminum	1.0 - 1.5
Dry Film Thickness	2.0 - 3.0
Minimum	2.0 Mils

2. System No. 39-4: Silicone Aluminum (600deg F Maximum)

   Surface Preparation: SSPC-SP10 Near-White Blast Cleaning - 1.0 Mil Surface

Profile

1st Coat: 39-661 Silicone Aluminum	1.0 - 1.5
2nd Coat: 39-661 Silicone Aluminum	1.0 - 1.5
Dry Film Thickness	2.0 - 3.0
Minimum	2.0 Mils

3.26 SURFACES EXPOSED TO H2S/H2SO4 (SEVERE EXPOSURE/IMMERSION)

A. CEMENTITIOUS SURFACES

System No. 120-1: Vinester

Surface Preparation: Abrasive blast clean to remove all laitance, fines and contamination.

1st Coat: 120-5002 Vinester	6.0 - 10.0*
2nd Coat: 120-5003 Vinester F&S	As Required**
3rd Coat: 120-5002 Vinester	12.0 - 18.0
4th Coat: 120-5001 Vinester	12.0 - 18.0
Dry Film Thickness	30.0 - 46.0
Minimum	36.0 Mils+

*First coat is to be applied by roller application or spray applied followed by backrolling.

**All surface voids, cracks, pinholes and other defects must be filled flush with the adjacent surfaces by putty knife, trowel, float, squeegee, or other suitable method.

B. FERROUS METAL SURFACES

System No. 120-2: Vinyl Ester

Surface Preparation: SSPC-SP-5 White Metal Blast Cleaning (3.0 Mil Profile)

1st Coat: 120-5002 Vinester	12.0 - 18.0
2nd Coat: 120-5001 Vinester	12.0 - 18.0
Dry Film Thickness	24.0 - 36.0
Minimum	30.0 Mils

3.27 EXTERIOR OF PRESTRESSED CONCRETE TANKS

A. System No. 156-1: New Tanks

Surface Preparation: Surface to be clean and dry.

1st Coat: 156-Color Envirocrete	4.0 - 6.0
2nd Coat: 156-Color Envirocrete	4.0 - 6.0
Dry Film Thickness	8.0 - 12.0
Minimum	10.0 Mils

B. System No. 156-2: Existing Tanks (Previously Painted)

Major cracks (wider than 1/64") can be repaired with TNEMEC Series 152 Tneme-Tape per instructions.

Surface Preparation: Remove all dirt, oil, grease, chalk, and loose paint per high pressure water blast (min. 3500 psi).

1st Coat: 151 Elasto-Grip	1.0 - 2.5
Stripe Coat: Stripe all hairline cracks with a brushed coat of Series 156 Envirocrete	3.0 - 5.0
Topcoat: 156-Envirocrete	4.0 - 6.0
Dry Film Thickness (Cracks)	8.0 - 13.5
Dry Film Thickness (Other)	5.0 - 8.5

3.28 SECONDARY CONTAINMENT AREAS

A. System No. 66-4: Epoxy Polyamide

This system will provide excellent resistance to most chemicals including petrochemicals.

Surface Preparation: Surfaces shall be clean and dry. Allow new concrete to cure for 28 days. Abrasive Blast Clean per SSPC-SP7 (Brush Off Blast)

Primer: 66-Color Hi-Build Epoxoline	4.0 - 6.0
Topcoat: 66-Color Hi-Build Epoxoline	4.0 - 6.0
Dry Film Thickness	8.0 - 12.0
Minimum	10.0 Mils

B. System No. 61-1: Amine Epoxy

This system offers superior chemical resistance to a wide range of chemicals. Use TNEMEC Series 63-1500 between coats as a filler and surfacer wherever it is required.

Surface Preparation: Surfaces shall be clean and dry. Allow new concrete to cure for 28 days. Abrasive Blast Clean per SSPC-SP7 (Brush Off Blast).

Primer: 61-5002 Tneme-Liner (Beige)	8.0 - 12.0
Topcoat: 61-5001 Tneme-Liner (Gray)	8.0 - 12.0
Dry Film Thickness	16.0 - 24.0

C. System 262-1: Flexible Polyurethane

Multiple passes may be required to achieve recommended film thickness. See Elasto-Shield application guide for additional instructions. This product is only available in black.

Surface Preparation: Surfaces shall be clean and dry. Allow new concrete to cure for 28 days. Abrasive Blast Clean per SSPC-SP7 (Brush Off Blast)

Coating: 262 Elasto Shield (Black)

Minimum Dry Film Thickness 50.0

3.29 CLEAR WATER REPELLENT FOR CONCRETE, MASONRY AND BRICK

A. Silane Sealer (Min. 20% Solids)

Surface Preparation: Allow new concrete to cure 28 days. Clean surfaces to be sealed by abrasive blasting or waterblasting.

COATING: BRICK, CONCRETE
HULS Chem-Trete BSM 20....75-200 SF/GAL

SPLIT FACED OR POROUS MASONRY
HULS Chemtrete PB.....35-100 SF/GAL

3.30 MANHOLES, WET WELLS AND LIFT STATIONS

A. System No. 120-1: Vinester

Surface Preparation: Abrasive blast clean to remove all laitance, fines and contamination.

1st Coat: 120-5002 Vinester	6.0 - 10.0*
2nd Coat: 120-5003 Vinester F&S	As Required**
3rd Coat: 120-5002 Vinester	12.0 - 18.0
4th Coat: 120-5001 Vinester	12.0 - 18.0
Dry Film Thickness	30.0 - 46.0
Minimum	36.0 Mils+

*First coat to be applied by roller application or spray applied followed by backrolling.

**All surface voids, cracks, pinholes and other defects must be filled flush with the adjacent surfaces by putty knife, trowel, float, squeegee, or other suitable method.

B. System No. 100-1: Crystaline Waterproofing

This system can be applied to concrete that is still wet or has not developed final cure. It can be used where wet surface conditions exist or where there is the potential for water intrusion due to hydrostatic pressure.

Surface Preparation: Surface to be clean and roughened by Brush Blasting or Acid Etching.

1st Coat: XYPEX Concentrate @ 1.5 lbs./SY
2nd Coat: XYPEX Modified @ 1.5 lbs./SY

3.31 CANAL PIPE CROSSINGS

A. System 90-97: Zinc/Epoxy/Urethane for New Pipe or Pipe Requiring Removal of Existing Coatings

Surface Preparation: SSPC-SP6 Commercial Blast Cleaning

Primer: 90-97 Tneme-Zinc	2.5 - 3.5
2nd Coat: 66-Color Hi-Build Epoxoline	2.0 - 3.0
3rd Coat: 74-Color Endurashield	2.0 - 3.0
Dry Film Thickness	6.5 - 9.5
Minimum	8.0 Mils

B. System No. 135-2: High Build, High Gloss Urethane for Marginally Cleaned Surfaces or

Topcoating Over Existing Systems

Surface Preparation: High Pressure Water Blast (min. 3500 psi) or Solvent Clean (SSPC-SP1) and Spot Hand and Power Tool Clean (SSPC-SP 2 & 3) or Brush Blast (SSPC-SP7). Existing coatings must be clean, dry and tightly adhering prior to application of coatings.

1st Coat: 135-Color Chembuild	3.0 - 4.0
2nd Coat: 74-Color Endurashield	2.0 - 3.0
	Minimum Dry Film Thickness 5.0

C. Ductile Iron Pipe (Above grade)

A test patch is always recommended to insure proper adhesion to existing coatings without lifting of existing coatings.

Surface Preparation: Clean and dry. (Do not solvent clean.)

1st Coat: TNEMEC Series 66*	3.0 - 5.0
2nd Coat: TNEMEC Series 66	3.0 - 5.0
	Minimum Dry Film Thickness 6.0 - 10.0

*Allow the black asphaltic coating to "bleed" through the first coat. After the first coat is cured, apply second coat.

3.32 PROJECT DESIGNER SYSTEMS REFERENCE GUIDE

A. STEEL

EXTERIOR (NON-IMMERSION)

A.1 System No. 73-1: Epoxy/High Build Urethane
A.2 System No. 73-2: High Build Urethane
A.3 System No. 2H-3: Alkyd Gloss
A.4 System 90-97: Zinc/Epoxy/Urethane

INTERIOR EXPOSURE (NON-IMMERSION)

B.1 System No. 69-1: High Solids Epoxy
B.2 System No. 66-2: High Build Epoxy
B.3 System No. 66-6: High Build Epoxy

IMMERSION

C.1 System No. 69-2: High Solids Epoxy (Non-Potable)
C.2 System No. 66-2: High Build Epoxy (Non-Potable)
C.3 System No. 20-1: Epoxy-Polyamide (Potable)
C.4 System No. 140: High Solids Epoxy (Potable Water)
C.5 System No. 46-30: High Build Coat Tar Epoxy (Non-Potable Only)
C.6 System No. 46-26: Coal Tar Epoxy (Non Potable Water Only)

B. OVERHEAD METAL DECKING, JOIST (INTERIOR EXPOSURE)

System No. 15-1: Uni-Bond

C. OVERHEAD METAL DECKING, JOINT (EXTERIOR EXPOSURE)

System No. 135-1: Chembuild

D. MILL COATED STEEL PIPE

System No. 66-3: Epoxy Polyamide

E. GALVANIZED STEEL-PIPE AND MISCELLANEOUS FABRICATORS

System No. 73-1: Epoxy/High Build Urethane

F. GALVANIZED STEEL-INTERIOR EXPOSURE (NON-IMMERSION) AND ALUMINUM IN CONTACT WITH CONCRETE

System No. 66-6: Polyamide Epoxy

G. GALVANIZED STEEL - IMMERSION (POTABLE WATER)

System No. 20-1: Epoxy Polyamide (Potable Water)

H. CHAIN LINK FENCES

System No. 22-1: Oil-Cementitious

I. CONCRETE

EXTERIOR-ABOVE GRADE

A.1 System No. 52-1: Modified Epoxy-Sand Texture
A.2 System No. 6-1: Acrylic Emulsion Low Sheen
A.3 System No. 156-1: Modified Acrylic Elastomer

EXTERIOR-BELOW GRADE

B.1 System No. 46-61: Coal Tar Pitch Solution
B.2 System No. 46-31: Coal Tar Epoxy
B.3 System No. 100-1: Crystaline Waterproofing

EXTERIOR/INTERIOR EXPOSURE (NON-IMMERSION)

C.1 System No. 6-1: Acrylic Emulsion Low Sheen
C.2 System No. 66-4: Epoxy-Polyamide
C.3 System No. 83-1: High Solids Catalyzed Epoxy

IMMERSION (POTABLE & NON-POTABLE)

D.1 System No. 66-4: Epoxy-Polyamide (Non-Potable)
D.2 System No. 104-5: High Solids Epoxy (Non-Potable)
D.3 System No. 46-31: High Build Coal Tar Epoxy (Non-Potable Only)
D.4 System No. 46-27: Coal Tar Epoxy (Non Potable Only)
D.5 System No. 20-2: Epoxy Polyamide (Potable)

D.6 System No. 139-2: Epoxy Polyamide (Potable)

INTERIOR EXPOSURE (NON-IMMERSION)

E.1 System No. 104-3: High Solids Epoxy
E.2 System No. 113-1: Acrylic Epoxy Semi-Gloss

J. CONCRETE FLOORS

A.1 System No. 67-1: Epoxy-Polyamide
A.2 System No. S67-1: Epoxy-Polyamide (Non-Skid)
A.3 System No. 73-12: Epoxy/Urethane
A.4 System No. 281-1: High Build Polyamide-Epoxy Flooring
A.5 System No. 221/281: Functional Flooring (Non-Slip)

K. POROUS MASONRY - EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 52-2: Modified Epoxy-Sand Texture
A.2 System No. 6-2: Acrylic Emulsion, Low Sheen
A.3 System No. 66-15: Epoxy-Polyamide (Interior)
A.4 System No. 104-6: High Solids Epoxy (Interior Only)
A.5 System No. 113-1: Acrylic Epoxy Semi-Gloss (Interior Only)
A.6 System No. 156-1: Modified Acrylic Elastomer

L. GYPSUM WALLBOARD

A.1 System No. 111-5: Acrylic Epoxy
A.2 System No. 66-22: Hi-Build Epoxoline
A.3 System No. 6-1: Acrylic Emulsion, Low Sheen

M. WOOD EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 23-4: Alkyd Semi-Gloss
A.2 System No. 6-5: Acrylic Latex

N. PVC PIPE EXTERIOR/INTERIOR EXPOSURE

A.1 System No. 66-23: Epoxy-Polyamide

O. INSULATED PIPE-INTERIOR EXPOSURE

A.1 System No. 6-1: Acrylic Emulsion, Low Sheen

P. HIGH HEAT SURFACES-FERROUS METAL

A.1 System No. 39-2: Silicone Aluminum (1200deg F Maximum)
A.2 System No. 39-4: Silicone Aluminum (600deg F Maximum)

Q. SURFACES EXPOSED TO H_2S/H_2SO_4 (SEVERE EXPOSURE/IMMERSION)

A.1 System No. 120-1: Vinester

R. EXTERIOR OF PRESTRESSED CONCRETE TANKS

A. System 156-1: New Tanks
B. System 156-2: System 156-2 Existing Tanks (Previously Painted)

S. SECONDARY CONTAINMENT AREAS

A. System No. 64-4: Epoxy Polyamide
B. System No. 61-1: Amine Epoxy
C. System No. 262-1: Flexible Polyurethane

T. CLEAR WATER REPELLENT FOR CONCRETE, MASONRY AND BRICK

A. Silane Sealer (Min. 20% Solids)

U. MANHOLES, WET WELLS & LIFT STATIONS

A. System No. 120-1: Vinester
B. System No. 100-1: Crystaline Waterproofing

V. CANAL PIPE CROSSINGS

A. System No. 90-97: Zinc/Epoxy/Urethane
B. System No. 135-2: High Build/High Gloss Urethane
C. Ductile Iron Pipe Above Grade: Series 66 High Build Epoxy

3.33 COATING SCHEDULE - TO BE DEVELOPED BY PROJECT AS NEEDED

END OF SECTION

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DIVISION 11 EQUIPMENT

SECTION 11230 GRAVITY BELT THICKENER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section shall include furnishing, unloading at the jobsite, handling, storage and installing a complete sludge thickening system including one (1) gravity belt thickener, complete with ancillary equipment, as specified and indicated on the drawings for a complete and operational system as required to meet the specified performance requirements.

B. Related Sections

1. Section 11235 – Polymer Feed System
2. Section 11240 – Sludge Pumps
3. Section 16010 – Electrical Requirements
4. Section 16122 – Motors
5. Section 16135 – Cabinets and Enclosures
6. Section 16144 – Disconnect Switches
7. Section 16262 – Variable Frequency Drives Below 75 HP
8. Section 16416 – Transient Voltage Surge Suppressors
9. Section 16422 – Motor Control
10. Section 16951 – Functional Testing
11. Section 17010 – Basic Measurement and Control Instruments
12. Section 17127 – Panel Instruments
13. Section 17411 – Control Strategies
14. Section 17442 – Instrument and Control Panels
15. Section 17452 – Programmable Logic Controller System

1.02 GENERAL

Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by the engineer.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01340 Shop Drawings, Project Data and Samples.

B. Sludge Thickener System

1. Submit documentation of manufacturer's experience.
2. Submit complete thickener system drawings, together with all piping, valves, conduits, wiring diagrams and controls for review by the ENGINEER.
3. Submit the following information for approval before equipment is fabricated:

a. Drawings of system showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all equipment and sufficient information to allow the ENGINEER to check clearances, connections, and conformance with the specifications.
b. Materials of construction of all equipment.
c. Manufacturer's catalog data, operating literature, specifications, performance and calibration curves for pumps, and auxiliary components.
d. Complete instrumentation, control, logic and power wiring diagrams in sufficient detail to allow installation of the instrumentation, controls, and electrical components.

4. Manuals
   a. Furnish manufacturer's installation, operation, and maintenance recommendations, bulletins, and spare parts lists.

C. Thickener Control Panel Drawings

1. Product data in accordance with control and instruments products specified in sections 17010 through 17452, and electrical products in accordance with pertinent sections of Division 16, including but not limited to the following:
   a. Enclosure dimensions, material type and required coatings
   b. Mounting support details.
   c. Power disconnect switches
   d. Wiring Terminal Boxes
   e. Air conditioning product and panel heat calculations for required cooling.
   f. Programmable controller with mounting rack, power supply, I/O modules and accessories
   g. Programmable Software provisions in PLC controller
   h. Control power transformers
   i. Circuit breakers
   j. Motor starters
   k. Instrument and control devices
   l. Voltage transient surge protectors
   m. Equipment Nameplates and/or labels.
2. Fabrication drawings including:
   a. Cabinet dimensions and detail layout of components
   b. Interconnection wiring and control diagrams
   c. Control schematics for motor starters and control devices
   d. Interconnection diagrams with VFD for speed control of Sludge thickener
   e. Interconnection diagrams of programmable controller with plant SCADA system.
   f. Interconnection diagrams for control of Sludge Input Valve.
   g. Interconnection diagrams for speed control of Polymer Unit
   h. Statement confirming compliance with fabrication requirements of UL-508.

1.04 WORKMANSHIP AND DESIGN

All components of the sludge thickening equipment shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy lubrication,

adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.

1.05 MATERIALS

A. All materials used in the construction of the sludge thickening equipment shall be of the best quality and entirely suitable in every respect for the service required. All structural steel shall conform to the ASTM Standard Specification for Structural Steel, Designation A36, unless otherwise noted. All iron castings shall conform to the ASTM Standard Specifications for Gray Iron Castings, Designation A48, and shall be of a class suitable for the purpose intended. Other materials shall conform to the ASTM Specifications where such specifications exist; the use of such materials shall be based on continuous and successful use under similar conditions of service.

B. Unless otherwise specified herein, all metal components in contact with polyelectrolyte or sludge shall be of Type 316 stainless steel. All fasteners, washers, pins, anchor bolts, etc. shall be Type 316 stainless steel.

C. All carbon steel plates, shapes, brackets, etc. shall have a minimum thickness of 1/4 inch and be hot-dip galvanized in accordance with ASTM A-123, thickness grade 100 (a minimum thickness of 4 mils). Painted surfaces other than those specified herein will not be considered as an acceptable substitute to this specification.

1.06 QUALITY ASSURANCE

Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The equipment shall be supplied by a firm which has been regularly engaged in the design, fabrication, assembly, testing, start-up and service of full scale gravity belt thickeners, of the same model and size as proposed, operating in the U.S., with similar sludges, for a period of not less than ten (10) years prior to the bid date of this contract, with a minimum of 20 installations. To insure that the highest standards are met each bidder shall be certified to ISO 9001 quality standards as a gravity belt thickener manufacturer in the United States. The bidder shall submit data to substantiate the manufacturers experience in accordance with the contract documents.

1.07 PATENTS

A. The Manufacturer shall warrant that the use of the sludge thickening system and its equipment, in the process for which the system has been expressly designed for, will not infringe on any U.S. or foreign patents or patents pending. In the event of any claim of infringement the manufacturer shall defend and indemnify the Owner free from any liabilities associated with the use of the patented equipment or process.

B. The Manufacturer shall grant to the Owner, in perpetuity, a paid-up license to use any inventions covered by patent or patents pending, owned, or controlled by the Manufacturer in the operation of the facility being constructed in conjunction with the equipment supplied under this contract, but without the right to grant sublicenses.

1.08 WARRANTY

A. The Manufacturer shall warrant in writing that all equipment supplied by them shall be free from defects in material and workmanship in accordance with Part 1.13 of Section 01030

Special Project Procedures.

B. The manufacturer shall warrant the frame and the coating to be free from manufacturing defects for a period of three years from the date of start-up, not to exceed three and a half years from the date of delivery. Neither the frame nor coating shall require preventive maintenance during the warranty period other than routine maintenance. The warranty shall include all parts and labor and shall cover the cost of repairing or replacing any item that fails during the warranty period, provided the damage is not due to misuse or neglect by others.

C. The manufacturer shall warrant the rollers and the coating to be free from manufacturing defects for a period of three years from date of start-up, not to exceed three and a half years from the date of delivery. Neither the rollers nor coating shall require preventive maintenance during the warranty period. The warranty shall include all parts and labor and shall cover the cost of repairing or replacing any item that fails during the warranty period, provided the damage is not due to misuse or neglect by others.

D. The manufacturer of the gravity belt thickener shall warrant the complete bearing assembly as specified herein for a period of five years from the date of start-up, or acceptance of the equipment, whichever occurs first. The warranty shall include all parts and labor for repairing or replacing any bearing assembly part that fails during the warranty period.

E. The belt shall have a width as herein before specified and shall have a minimum life of 2,000 hours continuous operation at the rated design conditions. This minimum belt life shall also cover belts damaged due to defects in the manufacture of the thickener or any of its components, and shall also cover the connecting splice.

1.09 CONDITIONS OF SERVICE

A. The sludge thickening equipment shall be designed to adequately condition and dewater the sludge so that a dewatered sludge cake is produced that easily discharges from the thickening unit without blinding and that may be handled by the pump or conveying equipment.

B. Each unit shall be designed to operate in the environment for which it is intended, continuously or intermittently on demand, and shall perform the required dewatering operations without spillage of water or sludge beyond the nominal machine envelope.

C. The description of the sludge to be fed to the gravity belt thickener is as follows:

Type of sludge: W.A.S. from an extended aeration plant, which is aerobically digested.

Feed solids, percent dry weight solids (d.w.s.)	0.5 - 1.5
pH	6.0 – 7.5

1.10 PERFORMANCE REQUIREMENTS

Each thickener shall be capable of meeting the following minimum performance criteria:

hydraulic capacity, g.p.m./meter	200
cake solids, percent d.w.s.	4.0 – 5.0
polymer, lbs/ton of d.w.s. in feed	15

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. The sludge thickening system shall consist of one (1) gravity belt thickener and all appurtenances. Each gravity belt thickener shall be a complete prefabricated unit consisting of at least a sludge conditioning system, a built-in retention tank, a gravity drainage section, a belt alignment and tensioning system, and a belt washing system. Only units having a measured belt of 2.2 meters shall be considered acceptable under this specification. The width of the belt area in actual contact with the sludge, known as the effective belt width, shall be 2.0 meters. The unit shall be the Aquabelt gravity belt thickener as manufactured by Ashbrook Simon-Hartley, Houston, Texas, or equal approved by the Owner.

B. The overall dimensions of the gravity belt thickener shall be such that the installation includes adequate room on one side for the removal of all rollers, as well as a minimum clearance of 3'-0" on all other sides of the unit. The overall height, width, and length of each thickener shall be 62 inches, 135 inches, and 239 inches respectively. The weight of the unit shall be no less than 7,200 pounds.

C. The minimum clearance requirements specified herein shall not relieve the contractor from allowing additional clearances for the proper installation, operation, and maintenance of the units including clearance to install and remove the unit. Should equipment other than that specified be proposed by the Contractor, the Contractor shall be responsible for any redesign based on the requirements contained herein.

2.02 SLUDGE CONDITIONING SYSTEM

A. The gravity belt thickener shall be provided with a sludge conditioning system, designed to efficiently mix polymer with the sludge, and to adequately condition the sludge for optimum thickening.

B. The sludge conditioning system shall be mounted at the inlet flange of the feed tank and shall consist of an in-line, non-clog static mixer, with a variable orifice and a vortex polymer injection ring, followed by a 316 stainless steel, 10 gauge minimum thickness retention tank with an integral 316 stainless steel 10 gauge minimum thickness feed chute at the inlet end of the thickening unit.

C. The sludge conditioning system shall be capable of providing the following performance:

1. The polymer and sludge must be instantly mixed (less than 1.0 second at 60 GPM).
2. Mixing energy must be independently adjustable during operation.
3. At the maximum flow rate, retention time must be at least 20 seconds to ensure adequate flocculation.
4. The mixer shall be capable of automatically opening to allow solids, which are larger than the preset opening to pass through the mixer without clogging, and then return again to the preset position.

D. The sludge conditioning system shall meet the following mechanical specifications:

1. The in-line mixer shall have a flanged, cast housing, an adjustable orifice plate with shaft and o-ring seal connected to an externally mounted lever and counterweight and a removable side plate for inspection and cleaning. All of the above parts,

except for the rubber o-ring and the hot-dip galvanized cast iron counterweight and lever arm, shall be constructed of Type 316 stainless steel.

2. The open throat area shall be fully adjustable downward and shall open automatically to prevent clogging.
3. The inlet to the flow-splitting manifold shall be fitted with a 3/4-inch male hose fitting connection. The four manifold outlets and polymer injection ring inlets shall be fitted with 1/2-inch male hose fittings that provide for the interconnection of clear flexible tubing. The Manufacturer shall provide four feet of 3/4 inch clear flexible tubing, sixteen feet of 1/2 inch clear flexible tubing and all necessary hose clamps with the sludge conditioning system.
4. The position of the externally mounted orifice plate lever, with the counterweight, shall be fully adjustable, within a 360 degree circle, to allow for adjustment of the mixing energy, regardless of the mounted position of the mixer, while the unit is in operation.
5. The retention tank shall be fabricated of Type 316 stainless steel, with a minimum 10 gauge thickness.
6. The feed chute of the retention tank shall be removable for ease of maintenance and cleaning.

E. The polymer mixer shall be designed specifically for this application. The use of check valves, modified check valves or pipe bends shall not be acceptable.

2.03 STRUCTURAL MAIN FRAME

A. The structural main frame shall be fabricated of steel members conforming to ASTM Standard Specifications for Structural Steel, Designation A36, into a rigid structure adequately braced to withstand loads with a maximum deflection of 0.010 inches at mid-span.

B. Structural members shall be structural beams, channel, pipe, or tubing with a minimum flange thickness of 3/8" and a minimum web/wall thickness of 1/4". The frame shall have a minimum safety factor under maximum load of 20 times the yield strength of the member. All bolts and fasteners used in the assembly of the structural frame shall have a minimum diameter of no less than 1/2".

C. Maximum load shall be based on the summation of forces applied to the frame from roller mass forces and belt tension forces. The belt tension forces exerted on the frame shall include a minimum loading of 40 pounds per lineal inch of belt width on the rollers, which equates to a belt tension of 20 pli.

D. Calculations certified by a registered Professional Engineer in the State of Florida showing the frame to be in compliance with the specification shall be submitted with the approval package.

E. The framework shall be of welded and/or bolted construction. All welding shall conform with the American Welding Society Structural Welding Code, latest edition.

F. The framework shall be prepared and coated after fabrication with hot-dip galvanizing in accordance with ASTM A 123, thickness grade 100 (a minimum thickness of 4 mils) to provide protection against the deteriorating effects of the environment. Zinc flame spray will not be considered an acceptable substitute to this specification. The structure shall be designed for installation on a prepared concrete foundation and secured with anchor bolts. Permanent lifting lugs shall be provided as necessary to allow installation and removal of

the gravity belt thickener. The construction shall allow easy access and visual contact of all internal components.

2.04 GRAVITY DRAINAGE SECTION

A. The dewatering zone of a belt thickener consists of a gravity drainage section and shall be fitted with an inlet distributor to accept sludge from the sludge conditioning system and to evenly distribute the conditioned sludge over the effective width of the moving filter belt.

B. The conditioned sludge shall be contained on the filter belt with Type 316 stainless steel barriers, 14-gauge minimum thickness, and equipped with replaceable rubber seals to prevent leakage.

C. The gravity drainage section shall provide a minimum effective drainage of 89.2 square feet. The effective drainage area shall be defined as the belt width between the sludge containment barriers times the belt length where drainage actually occurs.

D. The filter belt shall be supported in the gravity drainage section by a Type 316 stainless steel grid with a minimum thickness of construction of 10 gauge, fitted with replaceable ultra-high molecular weight high density polyethylene wiper bars spaced at a maximum of 2 1/2" along the length of the zone. The belt support grid shall be a minimum of 2 inches wider than the belt and so designed to reduce belt wear. Wiper bars constructed of fiberglass or other high friction materials, or table rollers, shall not be considered an acceptable substitute to this specification.

E. The gravity drainage section shall be furnished with chicanes (plows) to adequately furrow the conditioned sludge to facilitate drainage. The chicanes shall be constructed of high density polyethylene with hot dipped galvanized cast iron holders and so designed to reduce belt wear. Each row of chicanes shall be provided with a single lifting handle designed to remove the entire row of chicanes at least 6 inches from the belt and out of the sludge flow to facilitate cleaning. Chicanes shall be designed to be individually moved laterally or horizontally. The gravity section will be supplied with a minimum of 8 rows, with a total of 68 chicanes.

F. The manufacturer shall be required to demonstrate that individual chicanes shall be capable of allowing a 1" vertical obstruction on the belt to pass under them without damage to the equipment or moving another chicane.

G. Mounting brackets and supports for the chicanes shall be hot dip galvanized carbon steel or Type 316 stainless steel. All fasteners shall be Type 316 stainless steel.

H. Vacuum assisted or inclined gravity drainage sections, which are subject to flooding, will not be considered an acceptable substitute to this specification.

2.05 ADJUSTABLE RAMP

A. An adjustable ramp shall be provided adjacent to the discharge end of the thickening unit, which causes the thickened sludge to ascend the ramp prior to discharge. The ramp shall be fitted with a replaceable doctor blade as described in the section titled Doctor Blades elsewhere within this specification. The ramp shall extend across the width of the belt adjacent to the discharge end of the unit and be set at a sufficient height and angle so as to create an optimum backward rolling action of the sludge. The rolling action shall impart a shearing action to the sludge, which further relieves trapped water from between the

sludge particles, to enhance and assure optimum thickening.

B. The ramp assembly shall incorporate the following features:

1. The ramp shall be provided with an actuator which includes a manual crank which, when turned, affects the incline of the ramp with respect to the filter belt.
2. The ramp adjustment shall be capable of providing inclination angles of between 10 degrees and 45 degrees relative to the filter belt during operation.
3. The ramp shall be designed so the location of the leading edge of the doctor blade with respect to the belt remains the same regardless of the angle of inclination at which the ramp is set.
4. The ramp assembly shall be capable of being easily and quickly lifted away from the belt and out of the sludge path to facilitate cleaning during operation.
5. The angle of inclination of the ramp shall be capable of being adjusted by one man while the unit is in operation and without the use of tools.

C. All wetted components of the ramp assembly shall be fabricated of Type 316 stainless steel and all other components shall be hot dip galvanized carbon steel.

2.06 ROLLERS

A. Construction: All Solid Rollers shall be constructed using one-piece forge shafts and end plates. The forged stub shaft unit shall eliminate all welding of the roller shafts in the region of highest stress where the shafts join with the end plates. Welded up constructions of round bar and flat plates that create built in stresses and stress concentrations will not be acceptable. The forged stub shaft unit shall be welded to the roller shell with a machine-applied weld using the submerged arc process. The weld depth shall be equal to the wall thickness of the roller shell. The roller shall be machined so that the total indicated runout of the shell relative to the journals is 0.010 inch maximum. Total surface machining is required to provide a smooth surface for the coating of thermoplastic nylon.

B. Materials: The forged stub shaft unit shall be made of ASTM A572 Grade 50 Type 2 or equal. The roller shells may be ASTM A53 or equal. Drive roller shall be coated up to the point of insertion into the bearings by a 1/4-inch minimum thickness of Buna-N rubber. Solid rollers shall be coated with a 30-mil minimum thickness of thermoplastic nylon. See detail spec for these coatings herein.

C. Dimensions: All solid roller shells shall have a mill spec minimum wall thickness of 1/2 inch. Heavier walls shall be used where required to meet the maximum stress and deflection limits. The roller bearing journals shall be turned to 75 mm to accept direct mounted 75 mm bore bearings. The minimum thickness of the forged flange that forms the end plates shall be one (1) inch.

D. Stress and Deflection: The rollers shall be analyzed using finite element stress analyses. Certified calculations, showing the maximum stress to be less than 1/5 the yield strength of the material and the maximum deflection at mid span to be less than 0.050 inch shall be submitted as set forth in the contract documents. The standard load case for the rollers shall be a distributed load in the belt contact area equivalent to 20 pli belt tension, weight loading and drive torque. The standard load case for the other rollers shall be a distributed load in the belt contact area equivalent to 20-pli belt tension and weight loading.

E. The drive roller shall be coated with vulcanized Buna-N rubber to a minimum of 1/4 inch on the belt contact surface and 1/8 inch minimum thickness elsewhere so that no steel surface is exposed.

F. All other rollers shall be coated with 25-mil protective coating of thermoplastic nylon with the following properties:

Properties	Test Method	Value
Hardness, Shore D	ASTM D-2240	77
Specific Gravity	ASTM D-792	1.06 - 1.20
Impact Hardness, RT & 45 F (Direct Pass)	ASTM D-2794	160 in-lbs
Tensile Strength	ASTM D-638	6000 psi
Elongation	ASTM D-638	15%
Melting Point	ASTM D-789	370 deg. F
Abrasion Resistance (varies with color)	ASTM D-4060 CS17/1000/1000	8 - 18mg wt. loss (Taber abrader)

Buna N rubber coating shall have the following properties:

Tensile strength, ASTM D-412	2500 psi
Tear strength, die C, ASTM D-624	250 psi
Elongation at break, ASTM D-412	160%
Hardness, Shore A, ASTM D -676	90

G. Other types of protective coatings shall not be acceptable. Rollers shall be coated up to the point of insertion into the bearing block or shall have shafts and heads of Type 316 stainless steel. Carbon steel roller surfaces shall not be exposed to sludge or moisture. The use of rollers constructed entirely of Type 316 stainless steel, in lieu of rollers of carbon steel with protective coatings, shall be considered acceptable under this specification.

2.07 BEARINGS

A. All rollers shall be supported by greaseable, self-aligning roller bearings in sealed, splash proof, horizontal split-case pillow block housings. The bearings shall be attached to the shaft in a direct mount/shrink-fit fashion.

B. All bearings shall have a minimum L_{10} bearing life of 1,000,000 hours, calculated by using ANSI/AFBMA Standard 11-1990. The L_{10} life shall be based on the summation of forces applied to the bearings from belt speed, roller mass forces and belt tension forces. The belt speed used for the L_{10} life calculation shall be 40 meters per minute and the belt tension forces exerted on the rollers shall include a minimum loading of 40 pounds per lineal inch of belt width, which equates to a belt tension of 20 pli. Calculations based on the AFBMA/ISO capacity formula and certified by a registered Professional Engineer in the state of manufacture to show that all bearings comply with the specified requirements for minimum L_{10} bearing life at maximum loading shall be submitted to the Engineer with the submittal package.

C. Bearing housings shall be class 30 cast iron with two mounting bolts and four cap bolts. The housings shall allow the changing of bearings without any changes in the factory alignment of the roller. The roller side of the housings shall be sealed to provide adequate protection from moisture and grime, and shall have an integrally cast water trough which, when shrouded by a shaft-mounted splashguard, will divert waste from the bearing seal

area. The outer side of the housing shall be solid, without end caps or filler plugs. The housings shall be cleaned, iron phosphated, and coated with heat applied thermoplastic nylon to a thickness of 8-12 mils. All bolts, nut and washers shall be Type 316 stainless steel.

D. The bearing seal in the pillow block housing shall be of nonmetallic construction. A static sealing arrangement between the seal and the housing shall be a triple rubber seal constructed in a manner that prevents relative rotation between the roller shaft and the seal.

E. Bearing lubrication shall be performed through a monel or Type 316 stainless steel standard grease fitting mounted on the bearing housing. All bearings shall be outboard (externally mounted) and shall be greaseable while the unit is in operation. Lubrication shall not be required more often than once every six months. A dynamic sealing arrangement between the carrier/flinger and the bearing housing shall consist of a primary dynamic contact seal of ozone resistant rubber which shall seal by rotational contact with a machined housing surface. A secondary dynamic seal shall be a labyrinth seal between the carrier/flinger and the bearing housing which utilizes a metallic retaining ring to hold the seal assembly in position within the housing.

2.08 BELT WASH SYSTEM

A. Each gravity belt thickener shall be equipped with a belt wash station for the belt. The station shall consist of a spray pipe fitted with spray nozzles that is contained within a fabricated housing which encapsulates a section of the belt. The housing and nozzle assembly shall be readily removable.

B. Nozzle spacing and spray pattern shall be such that the sprays from adjacent nozzles overlap one another at the belt surface. The spray pipe and nozzles shall be of Type 304 or 316 stainless steel construction. Individual nozzles must be replaceable.

C. The housing shall be fabricated from Type 316 stainless steel with a minimum thickness of 14 gauge. The housing shall be sealed around the belt to prevent mist escaping from the enclosure. The seals shall be replaceable without disassembly of the wash station.

D. The spray pipe shall be furnished with a drain valve that has an external handwheel attached to a stainless steel cleaning brush located inside the spray pipe. One full turn of the handwheel shall cause the brush bristles to enter each spray nozzle, dislodge any solid particles that have accumulated, and open the valve and allow the solid particles to be flushed into the drainage system.

E. The belt wash spray tube shall be of the type manufactured by Appleton Manufacturing, Menasha Corporation, Menasha, Wisconsin, the Heinrich Stamm Company, Worms Am Rhein, West Germany, or equal. Other types of belt wash spray tubes are not acceptable.

F. The belt wash station shall be positioned such that the washing is performed after the cake has been discharged from the belt. The belt wash station shall extend over the full width of the filter belt by a minimum of two (2) inches. The belt wash station shall be designed such that it can easily accommodate cleaning from either the clean or dirty side of the belt, or both. The spray tube shall be easily moved between these two positions as required by the demands of the process.

G. The belt wash system shall be suitable for use with plant effluent water (maximum 200

mg/l solids) supplied at a minimum pressure of 85 psig and shall be designed to operate on a maximum flow of 40 gpm.

H. Gravity belt thickener(s) requiring washwater pressure in excess of 85 psig shall be furnished with separately mounted washwater booster pump(s) rated at sufficient capacity and discharge head to meet the process requirements. All controls and equipment necessary to provide a complete and operating system shall be provided for the pump(s), including controls from the machine control panel as specified hereinafter.

I. The gravity belt thickener shall be provided with a dedicated connection for belt wash water that includes a pressure switch for detection of low water pressure and a motor operated ball valve installed for control of the washwater supply line, both of which shall be mounted on the gravity belt thickener. The belt wash station shall discharge the washwater filtrate to the sump.

2.09 BELT ALIGNMENT SYSTEM

A. The belt shall be provided with an automatic belt alignment system to assure proper alignment of the belt at all times. Belt alignment shall be accomplished using a self-contained system for each unit that does not require an external power source beyond what is required for instrumentation.

B. The belt alignment system shall be provided with sensing devices designed to ride on the edge of the belt to detect position. The sensing device shall include a spring-loaded arm to maintain contact with the belt edge and be fitted with a ceramic plate for abrasion resistance. The arm shall operate a pilot valve, which in turn affects the position of a hydraulic actuator connected to a pivoted belt alignment roller. The pivoting action of the belt alignment roller shall cause this roller to skew from its transverse position to guide the belt centrally along its path.

C. The alignment system shall function as a continuous automatic belt guidance system and shall be an integral part of the thickener. The alignment system shall operate with smooth and slow motions resulting in a minimum of belt travel from side to side. The use of electrical servos or systems which utilize devices that maintain alignment by a large snap action-type alternating movement of the alignment roller shall not be considered acceptable to this specification. Rollers for the belt aligning system shall be constructed as specified under "Rollers". Support bearings for these rollers shall be as specified under "Bearings".

D. Back-up proximity switches for the belt alignment system shall be provided on the machine with sufficient connections to de-energize all drives and sound an alarm in case of belt over-travel. All piping, valves, fittings, and controls necessary to provide a complete and operational belt alignment system shall be included on the unit(s). A hydraulic unit shall be provided as specified under "Hydraulic system".

2.10 BELT TENSIONING SYSTEM

A. The gravity belt thickener shall be provided with a belt tensioning system. The belt tensioning system shall be hydraulically actuated. The belt shall be furnished with one tension roller. Rollers for the belt tensioning system shall be cylindrical in shape and constructed as specified under "Rollers". The ends of the shaft shall be supported by bearings, as specified under "Bearings".

B. Tensioning systems shall have two hydraulic cylinders for the belt with a mechanism to synchronize their position and maintain absolute parallel tension across the entire width of the belt. A proximity sensor for the belt tensioning system shall be provided on the unit with sufficient contacts to de-energize the drive and sound an alarm in case of belt breakage. The hydraulic cylinders shall be mounted on the edges of the thickener frame for easy access and maintenance.

C. The belt tensioning system shall accommodate a minimum of 2.5% increase in belt length. Manual or electric servo tensioning systems shall not be considered acceptable in this specification.

2.11 HYDRAULIC SYSTEM

A. Each thickener shall be provided with a dedicated hydraulic power system to provide pressurized oil for the steering and tensioning. The unit shall consist of a one-gallon reservoir; variable-displacement pressure compensated hydraulic oil pump and drive motor, hydraulic oil filter (reusable), pressure gauges, piping, valves and cylinders to make a complete operational system.

B. The pump, motor, reservoir, oil filter and valves shall be mounted directly to the thickener frame to minimize excess piping runs, fittings and hoses. All hydraulic lines shall be properly sized for the pressure and flow of the unit. Pressurized hydraulic lines shall be 316SS tubing and shall be rigidly supported on the structural frame of the thickener. Flexible lines to cylinders, low-pressure connections to the reservoir, etc. shall be hose of the material and construction appropriate to the application. The hydraulic reservoir shall be made of high-density polyethylene (HDPE) and shall be translucent to allow visual inspection of the oil level.

C. The pump motor shall be a 1hp and shall not exceed a noise level of 70 bBa. The motor shall be a cast iron TEFC 1,200 rpm, NEMA B design with a C face mounting for the hydraulic pump adapter.

D. Maximum system pressure shall be set equal to the highest pressure required to obtain the desired operating belt tension. The maximum system operating pressure shall be set not to exceed 1,000 psi.

E. Hydraulic system controls shall be grouped for easy access and ease of operation. There shall be means provided to retract the belt tension cylinders for service. The valves, fittings, manifold and associated parts shall be of non-corroding materials such as FRP, glass filled Nylon or stainless steel.

F. The oil pressure gauge for the belt tension cylinders shall indicate oil pressure in PSI and the belt tension in PLI. Normal operating limits shall be indicated on the face of each gauge. Low-pressure switch (es) shall be provided to sense the absence of belt tension pressure. Hydraulic cylinders shall have a non-corrosive body and 316 stainless hardware and cylinder rod. The cylinder rod shall be solid stainless with a hardened polished seal contact surface. Chrome or nickel plated rods are not acceptable.

2.12 BELT DRIVE

A. The drive shall be capable of either an A.C. variable speed operation controlled from the thickeners control panel as specified herein or a manual, mechanical-variable handwheel speed adjustment located on the drive.

B. The A.C. variable speed operation shall be controlled through cyclical variation in motor frequency, which is operator set at the variable frequency drive (VFD) in the control panel. Speed reduction shall take place in a helical gear-type reducer. The drive motor shall be of NEMA B design and be furnished with provisions for use on a 230/480 volt, 60 Hz, 3-phase power supply. The motor shall be rated for severe duty with an Insulation Class of F, AGMA class II for 24 hour service, and the service factor shall be 1.4 or greater to ensure that the drive will not fail under even the most extreme operating conditions.

C. The drive roller shall be constructed as specified under "Rollers" and shall be surfaced with a Buna-N rubber coating (Shore A hardness 90-95) to permit slip-free transmission of driving torque to the belt. The ends of the shafts of each drive roller shall be equipped with a support bearing as specified under "Bearings". Roller shafts and end plates shall be coated up to the point of insertion into the bearing block.

D. The use of a chain-and-sprocket or belt to transfer power to the drive will not be acceptable.

2.13 FILTER BELT

A. The gravity belt thickener shall incorporate the use of a dewatering belt constructed from seamed fabricated monofilament polyester, wear-resistant plastic materials, or combination monofilament polyester and stainless steel material. The mesh design shall be selected for optimum dewatering of the sludge to be processed with minimum blinding of the filter bed.

B. Belt selection shall be based on the manufacturers experience obtained from testing the sludge during start-up of the gravity belt thickener(s) or at other installations dewatering similar sludges with similar polyelectrolyte conditioning chemicals.

C. The belt and connecting splice shall be designed for a minimum tensile strength equal to five times the normal maximum dynamic tension to which the belt shall be subjected. The splice shall be designed to fail before the belt and shall be constructed of Type 316 stainless steel. Belts shall be designed for ease of replacement with a minimum of thickener down time.

2.14 DOCTOR BLADES

A. Each thickener shall be provided with a doctor blade to assist in the removal of adherent sludge from the filter belt at the discharge end of the gravity zone. The doctor blade shall be mounted so that thickened sludge will be continuously doctored from the belt. The blade shall be at least 1-1/2 inches wider than the belt. The doctor blade shall be ultra high molecular weight polyethylene and shall be replaceable and designed to wear before the filter belt. The blade shall be affixed to a tensioning mechanism that maintains a force against the surface of the belt. The blade and assembly shall be fabricated with sufficient stiffness so that the blade does not warp, distort or bow under normal service conditions.

B. The assembly shall be equipped with devices to enable the blade to be quickly released and locked in position away from contact with the belt for cleaning and maintenance. The doctor blade must hold itself no less than two inches away from the belt surface when disengaged and must have an actuating lever or handle on both sides of the thickener.

C. Fiberglass or other high friction blade materials shall not be considered acceptable to this

specification.

2.15 DRAINAGE PANS

Drainage pans shall be supplied as necessary to contain all filtrate within the gravity belt thickener without splashing and to prevent re-wetting of downstream cake. Filtrate pans shall be constructed of minimum 14 gauge 316 stainless steel suitable for the intended service. Other materials, such as FRP or molded plastic pans, are not considered adequate and shall not be permitted. All drainage piping furnished shall be adequately sized for the intended service and rigidly attached to the frame. Flushing connections or similar provisions shall be provided for easy access during cleaning. Drainage pans shall be located such that the moving belt does not come into contact with the pans under any conditions.

2.16 POWER AND CONTROL SYSTEM

A. Each gravity belt thickener shall be provided with a control panel that will contain the necessary control devices and equipment for controlling the thickening process as described herein. The control panel shall include a U.L.508 label and it shall be assembled in a U.L. 508 approved facility.

B. General Requirements

1. The control panel enclosure shall be NEMA 4X, fabricated of Type 304 stainless steel and painted white, rated to resist corrosive and humid environment. The control panel shall operate on a 460 VAC, 60 hertz, 3-phase power input.
   a. A main disconnect circuit breaker and operator mechanism shall be included. When the disconnect is in the open position, all power shall be removed from the control system.
   b. IEC-rated across-the-line motor starters and motor circuit protector shall be provided for the hydraulic unit and washwater pump.
   c. A variable frequency drive (VFD) shall be supplied for speed control of the belt drive, in accordance with VFD products specified in section 16262 .
   d. Short circuit protection and and individual thermal overload protection shall be provided for each motor.
   e. A control power transformer and low voltage power supplies shall be included for 120 VAC control power and low voltage to the system.
   f. All logic functions for the system shall be performed by an industrial programmable logic controller (PLC) located in the control panelin accordance with quality PLC products specified in section 17452.
   g. Provide voltage surge protection for 480 volts equipment, 120 volts controls and low voltage components.
2. Also located on the control panel shall be an EMERGENCY STOP pushbutton. It shall be an illuminated mushroom head style push-pull operator that when depressed shall immediately de-energize all moving equipment in the system. An alarm horn shall be included for audible alarm annunciation.
3. Cabinet shall consist of two sections with one barrier for separation of low voltage components and 480 volts controls.
4. All control components shall include identification nameplates.

C. Additional Control Panel Components

1. As a minimum, the following control pilot devices shall be located on the front of

the control panel and as shown on process and instrumentation (P&IDs) drawings:

Emergency Stop Push Button
HAND/OFF/AUTO MODE selector switch
HAND MODE indicator
AUTO MODE indicator
AUTO START pushbutton
AUTO STOP pushbutton
SYSTEM RESET pushbutton
ALARM SILENCE pushbutton
LAMP TEST pushbutton
THICKENER READY indicator
THICKENER OFF/ON selector switch
WASHDOWN CYCLE ON indicator
WASHWATER PUMP START pushbutton
WASHWATER PUMP STOP pushbutton
WASHWATER PUMP RUNNING indicator
HYDRAULIC PUMP START pushbutton
HYDRAULIC PUMP STOP pushbutton
HYDRAULIC PUMP RUNNING indicator
BELT DRIVE START pushbutton
BELT DRIVE STOP pushbutton
BELT DRIVE RUNNING indicator
BELT DRIVE SPEED controller (0 – 100%)
SLUDGE PUMP START pushbutton
SLUDGE PUMP STOP pushbutton
SLUDGE PUMP RUNNING indicator
SLUDGE PUMP SPEED potentiometer
SLUDGE PUMP SPEED indicator (0-100%)
POLYMER PUMP START pushbutton
POLYMER PUMP STOP pushbutton
POLYMER PUMP RUNNING indicator
POLYMER PUMP SPEED controller (0-100%)
THICKENED SLUDGE PUMP START pushbutton
THICKENED SLUDGE PUMP STOP pushbutton
THICKENED SLUDGE PUMP RUNNING indicator
LOW WASHWATER PRESSURE indicator
LOW HYDRAULIC PRESSURE indicator
BELT MISALIGNED indicator
BELT BROKEN indicator
HIGH SLUDGE indicator
EMERGENCY STOPPED indicator
SLUDGE HOPPER HIGH LEVEL indicator
BELT DRIVE FAIL indicator

2. The panel shall accept the following discrete inputs from others. The signals shall be normally open dry contacts and shall close when the equipment is running.
   a. Thickened sludge pump running
   b. Sludge pump running
   c. Polymer pump running
3. The control panel shall provide the following discrete signals for use by others. The signals shall be dry contacts.
   a. Thickener running (N.O. close when running)
   b. Thickener fault (N.O. close on alarm)

c. Thickened sludge pump run (N.O close to run)
d. Sludge pump run (N.O. close to run)
e. Polymer pump run (N.O. close to run)

4. Level interlocks in the sludge hopper shall be provided. High-level alarm, mid-level pump start, and low-level stop are required to control the thickened sludge pump.
5. The control panel shall accept the following analog signals from others.
   a. Sludge pump speed (4-20 mA)
   b. Polymer pump speed or (4-20 mA)
6. The control panel shall provide the following analog signals.
   a. Sludge pump speed (4-20 mA)
   b. Polymer pump speed (4-20 mA)
7. Air Conditioning Equipment.
   a. Provide an air conditioning unit mounted on the exterior side of the panel, for cooling electronic components and exhausting operating heat from the panel. The enclosure for the air conditioning unit shall be 304 stainless steel material painted white and entire unit shall be NEMA 4X construction, rated for outdoor corrosive and humid environment.
   b. Air conditioning controls shall include a thermostat.

D. Sequence of Operation

1. Automatic Mode
   a. The thickener may be operated in the automatic mode by placing the HAND/OFF/AUTO selector switch in the AUTO position. The AUTO MODE indicator will illuminate and the operator will press the AUTO START pushbutton. At this time, the hydraulic pump, washwater pump and washwater valve will be energized, and a belt tensioning time delay will start.
   b. After the belt tensioning timer times out, the belt drive will be energized and a belt pre-wet time delay will start. After the pre-wet timer times out, the THICKENER READY pilot light will be illuminated and, if the THICKENING OFF/ON selector switch is in the ON position, the sludge and polymer pumps will be energized, and the thickened sludge pump shall be enabled. The operator may adjust the belt speed and the flows of sludge and polymer via the P48 controllers provided.
   c. Pressing the AUTO STOP pushbutton will de-energize the sludge and polymer pumps, disable the thickened sludge pump, illuminate the WASHDOWN ON pilot light, and start a wash down time delay. After the wash down timer times out, the belt drive, washwater valve, washwater pump, and hydraulic pump will be de-energized.
2. Manual Mode
   a. The manual mode is intended for maintenance and emergency operation only, therefore there shall be no interlocks or time delays in equipment startup.
   b. To operate the thickener in the manual mode, the operator will place the HAND/OFF/AUTO selector switch in the HAND position. The HAND MODE indicator will be illuminated. The operator will start the washwater pump by pressing the WASHWATER PUMP START pushbutton; start the hydraulic pump by pressing the HYDRAULIC PUMP START pushbutton. Anytime the washwater pump is running, the washwater valve shall be energized. Pressing the BELT DRIVE START pushbutton will energize the belt drive. At this time, the operator will start the sludge pump by pressing

the SLUDGE PUMP START pushbutton, start the polymer pump by pressing the POLYMER PUMP START pushbutton, and start the thickened sludge pump by pressing the THICKENED SLUDGE PUMP START pushbutton.

c. The system shall be stopped by pressing the respective STOP pushbutton in the reverse order stated above.

3. Faults

a. When any of the following fault conditions occur, in automatic or manual mode, the appropriate fault indicator will be illuminated, the alarm horn will sound and the thickener and all equipment will be de-energized.

EMERGENCY STOP
LOW WASHWATER PRESSURE (w/time delay)
LOW HYDRAULIC PRESSURE (w/time delay)
BELT MISALIGNED
BELT BROKEN

b. The following fault conditions shall initiate the wash down cycle in the automatic mode (annunciation only in the manual mode):

HIGH SLUDGE

4. Additional Control Modes and Sequence of Operation

a. Provide software logic in the thickener control panel PLC, according to basic Control Strategies specified in section 17411.

b. Coordinate with Owner's subconsultant for SCADA software requirements and provide all necessary products and services to interconnect the thickener control panel with plant SCADA network, and operate the thickener system according to Control Strategies specified in section 17411.

E. Additional Electrical and Control Requirements

1. System electrical, instrumentation, and control components shall be meet product quality and requirements specified in pertinent product section of Division 16 - Electrical and Division 17 - Instrumentation and Controls, including compliance with pertinent building codes.
2. Provide all conduits, boxes and/or enclosures for wiring terminations, and wiring between the thickener No. 2 control panel and the thickener electromechanical components and instruments, as necessary for a complete working system
3. Provide testing of all new wiring to verify adequate insulation level, free of defects and/or incorrect termination.
4. Provide a disconnect safety switch with means to lockout for each motorized component.
5. Provide all necessary components in the thickener No. 2 control panel for interconnection and communication with the plant SCADA PLC network.

2.17 EMERGENCY TRIP CORD SYSTEM

Each thickener shall have an emergency trip cord system for stopping the thickener and

directly related equipment. The system shall consist of a switch and pull cable that encircles all sides of the thickener and is supported on the main frame. Both ends of the cable shall be terminated at the switch on opposite ends of an actuating arm. Pulling the cable at any point shall actuate the switch by rotating the arm and locking it in the tripped position. A separate spring loaded lever must be depressed to reset the actuating arm to the normal position. The switch shall have a visible signal that it is in the normal or actuated position. The switch shall be wired so that upon actuation, the thickener and directly related devices, such as the sludge feed pump, polymer feed pump, hydraulic pump, washwater system, etc. shall be deactivated or stopped. The switch enclosure shall have at least a Class II, Division 1 & 2, Group E, F, & G rating. The cable shall be mounted and supported so that there are no fixed or binding points along the entire run to the switch.

2.18 SPARE PARTS

The following spare parts shall be furnished with each gravity belt thickener:

1. One filter belt for each thickening unit supplied.
2. Two complete sets of doctor blades for each thickening unit supplied.
3. One of each size and type of roller bearing complete with bearing seals for each thickening unit supplied.
4. Two complete sets of rubber seals for the gravity zone and belt washbox for each thickening unit supplied.
5. One hydraulic unit oil filter for each thickener supplied.
6. Five (indicating) lamps of each type installed in control panel
7. One digital output module and input module on the PLC
8. One analog output module and analog input module on the PLC9. Two fuses of each type installed in control panel
10. Two control push buttons of each type installed in control panel

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING

D. Equipment shall be packaged for shipment and handling to prevent physical and environmental damage.

E. Equipment shall be transported to the jobsite using the manufacturer's customary method of shipment.

F. Equipment shall be off-loaded in accordance with the manufacturer's recommendations.

3.02 STORAGE

C. All equipment shall be stored in accordance with the manufacturer's written instructions.

D. Equipment shall not be stored on the ground. Equipment shall be placed on cribbing, or otherwise stored off the ground.

E. Special provisions, as directed by the manufacturer, shall be made for storage in excess of three months.

3.03 INSTALLATION

Equipment shall be installed in accordance with the manufacturer's recommendations and procedures as set forth in the installation manual furnished by the manufacturer.

3.04 INSTALLATION SUPERVISION, START-UP, AND OPERATOR TRAINING

A. Services of the manufacturer's factory trained representative, who is specifically knowledgeable in the type of equipment specified herein, shall be provided during the equipment installation period. Upon complete installation of equipment by the Contractor, including placement of equipment, setting and leveling the equipment, piping and electrical connections to all the equipment specified herein, the manufacturer's service representative will approve the installation and begin start up and training.

B. Provide testing for all field installed equipment, including wiring, control devices and motorized electrical equipment. Submit a certified equipment testing report, confirming that all equipment functions according to specified requirements.

C. Upon approval of the installation, the services of the manufacturer's factory trained representative shall be provided at the project site for equipment start-up and calibration. During the start-up and calibration phase the manufacturer's representative shall inspect all system components for proper connection and alignment and assist the installation contractor in placing the equipment in a proper operating condition.

D. Upon satisfactory completion of the start-up and calibration, a representative of the manufacturer shall be provided to instruct Owner's personnel in the proper operation and maintenance of the equipment. The manufacturer's representative who will be providing the instruction shall have prior operation, maintenance and instructing experience acceptable to the Engineer. The contractor shall submit the individual's name and qualifications to the Engineer for approval at least one week prior to the scheduled operating and maintenance instruction sessions. The number of days listed below for services of the manufacturer's factory trained representative shall be provided when requested by the Owner or the Engineer during the contract period.

E. All of the above sessions shall be completed in a total of one trip to the jobsite by the manufacturer's representative. The equipment manufacturer will request in writing that all installation prior to arriving at the jobsite be completed by the Contractor. If the equipment manufacturer arrives at the jobsite and equipment installation is not complete, the equipment manufacturer shall bill the Contractor at the manufacturer's standard service rates, or as agreed to at the time of the service request, and there shall be no additional cost to the Owner.

Period	Number of 8-hour days
Inspection / Start Up and Calibration	3
Operator Training	2

END OF SECTION

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SECTION 11235 POLYMER FEED SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section shall include furnishing, unloading at the jobsite, handling, storage and installing two (2) polymer feed systems, separately assigned to and controlled through a gravity belt thickener, complete with ancillary equipment, as specified and indicated on the drawings and as required for a complete and operational system to meet the specified performance requirements.

B. The polymer system shall be a skid mounted system with interconnecting piping and wiring complete within skid limits. Skids shall be capable of being mounted back-to-back on an existing concrete pedestal. Modifications necessary to accommodate the existing pedestal shall be made by the equipment manufacturer prior to shipping equipment to the site. On-site modifications shall not be acceptable.

C. Equipment included with each polymer system includes:

1. Mixing Chamber
2. Dilution water controls
3. Neat polymer pump
4. Calibration column
5. Pressure reducing valve (for dilution water)
6. Solenoid control valve (for dilution water)
7. System Controls

D. Related Sections

16. Section 11230 – Gravity Belt Thickener
17. Section 16010 – Electrical Requirements
18. Section 16122 – Motors
19. Section 16135 – Cabinets and Enclosures
20. Section 16144 – Disconnect Switches
21. Section 16416 – Transient Voltage Surge Suppressors
22. Section 16422 – Motor Control
23. Section 16951 – Functional Testing
24. Section 17010 – Basic Measurement and Control Instruments

1.02 GENERAL

Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by the engineer.

1.03 SUBMITTALS

D. Submittals shall be in accordance with Section 01340 Shop Drawings, Project Data and Samples.

E. Polymer Feed System

1. Submit documentation of manufacturer's experience.
2. Submit complete polymer feed system drawings, together with all piping, valves, conduits, wiring diagrams and controls for review by the ENGINEER.
3. Submit the following information for approval before equipment is fabricated:
   a. Drawings of system showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all equipment and sufficient information to allow the ENGINEER to check clearances, connections, and conformance with the specifications.
   b. Materials of construction of all equipment.
   c. Manufacturer's catalog data, operating literature, specifications, performance and calibration curves for pumps, and auxiliary components.
   d. Complete instrumentation, control, logic and power wiring diagrams in sufficient detail to allow installation of the instrumentation, controls, and electrical components.
4. Manuals
   a. Furnish manufacturer's installation, operation, and maintenance recommendations, bulletins, and spare parts lists.

1.04 QUALITY ASSURANCE

Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The polymer system shall be the standard equipment of the supplier engaged in the manufacture of similar type equipment. Equipment manufacturer shall have a minimum of ten years of experience manufacturing like equipment. The bidder shall submit data to substantiate the manufacturer's experience in accordance with the contract documents.

1.05 WARRANTY

Polymer feed system shall be warranted in accordance with Part 1.13 of Section 01030 Special Project Procedures.

PART 2 PRODUCTS

2.01 MANUFACTURER

The polymer feed system shall be the PolyBlend® Model M2400-D4AA as manufactured by WTChemfeed, or approved equal.

2.02 SYSTEM DESCRIPTION

A. Multi-Zone Mixing Chamber

1. Polymer and water shall be mixed in a chamber designed to create sufficient mixing energy. The design shall include a motor-driven impeller that will create

high fluid sheer. Solution shall undergo a tapered mixing intensity slope as it exits the initial high sheer zone and passes through a second low shear zone, isolated by a baffle. Polymer activation efficiency shall be consistent over the dilution water range.

2. The mixing chamber shall be transparent to allow viewing of mixing intensity. An opaque mixing chamber shall be unacceptable.
3. The impeller shall be driven by a 1 HP maximum duty motor. The motor shall be TEFC. The impeller speed shall be 3450 rpm, minimum. The motor shall be direct-coupled to impeller shaft.
4. The mixing chamber shall include a stainless steel injection check valve.

B. Dilution Water Control

1. Dilution water shall be split into two streams, 120-1200 GPH for primary mixing (456-4560 LPH), and 120-1200 GPH for secondary or post dilution (456-4560 LPH). Primary water flow shall supply the mixing chamber. Secondary water flow shall be used to post dilute the activated polymer stream. These two streams shall be completely blended by a static mixer prior to exiting the unit.
2. Unit shall have an electric solenoid valve for on/off control of total dilution water flow. Flow indicators and flow control valves shall be provided for each dilution water stream.
3. A suitably sized pressure reducing valve shall be supplied for installation in the dilution water line. Pressure reducing valve shall be constructed of bronze with adjustable output pressure of 25-75 psig to reduce incoming line pressure variations. Pressure reducing valve shall be as manufactured by Watts Regulator model U5 or U5B.
4. Dilution water and solution output connections shall include 304 stainless steel unions connected to the chassis.

C. Pump

Unit shall have a neat polymer metering pump. Pump shall be positive displacement, diaphragm type. Metering pump range shall be 0.3 - 4.0 GPH neat polymer (1.1-15.2 LPH). Pump shall be an integral part of the polymer feed system, shall be provided by the system manufacturer, and shall be mounted on the polymer feed system skid. Polymer pump head shall be fabricated of clear acrylic and shall have a priming port.

D. Controls

1. Each unit shall be dedicated to one gravity belt thickener.
2. Each unit shall be powered through an on-off-remote circuit controlled by a three-position switch. In the remote switch position, the unit shall accept a run signal from its respective gravity belt thickener vendor control panel. Unit is manually powered in the on position.
3. Unit shall accept a 4-20 mA analog signal to pace the polymer metering pump. This signal shall be processed by a pump controller that may be mounted remotely. The controller shall have an LCD readout capable of displaying strokes per minute, strokes per hour, gallons per minute, gallons per hour, liters per minute, or liters per hour. The controller shall have touchpad control for pump stroke frequency and a mode touchpad (internal-off-external) for pacing signal selection. The controller shall have the ability to perform a drawdown calibration to determine the actual volume per stroke the polymer system feeds, to allow the controller to display theoretical polymer flow rates in real time.

4. Unit shall detect loss of water flow, sensing that water flow has been interrupted for any reason, will place the polymer pump on standby and will restart it automatically when flow is restored.
5. An integral timer shall monitor loss of flow and energize contacts indicating alarm after 15 seconds of continuous loss.
6. A neat polymer thermal loss of flow switch shall be supplied on the discharge of the neat polymer metering pump to detect absence of polymer flow. Thermal flow switch assembly shall include sensor, flow block and controls. Alarm output contacts shall be supplied for the plant control system after adjustable time delay.

E. Calibration cylinder

A suitably sized calibration cylinder shall be supplied for the neat polymer feed pump. Cylinder shall be mounted to frame with PVC isolation ball valves. Cylinder shall be calibrated in mL, and be constructed of clear PVC with slip on cap and ½ inch NPT vent connection.

F. Spare Parts Kit

Spare parts kit shall include mechanical seal, mixing chamber o-rings, injection check valve, and pump liquid end rebuild kit.

2.03 TECHNICAL DATA

A. Connections – Plumbing

1. Dilution water inlet, 1½" FNPT
2. Neat polymer inlet, ½" FNPT
3. Solution discharge, 1½" FNPT

B. Connections – Electrical

1. Standard, grounded male plug – 120 / 1/ 60, 15 amps
2. Plug in connection – 4-20 mA signal input
3. Terminal blocks for dry contact input for remote start, dry contact alarm output, dry contact run output, and control switch status output.

C. Dimensions

Frame – 36" wide x 20" deep x 40" high

D. Materials of Construction

1. Structural frame – 304 stainless steel
2. Plumbing – PVC
3. Mixing chamber – PVC, acrylic

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING

G. Equipment shall be packaged for shipment and handling to prevent physical and environmental damage.

H. Equipment shall be transported to the jobsite using the manufacturer's customary method of shipment.

I. Equipment shall be off-loaded in accordance with the manufacturer's recommendations.

3.02 STORAGE

F. All equipment shall be stored in accordance with the manufacturer's written instructions.

G. Equipment shall not be stored on the ground. Equipment shall be placed on cribbing, or otherwise stored off the ground.

H. Special provisions, as directed by the manufacturer, shall be made for storage in excess of three months.

3.03 INSTALLATION

A. Equipment shall be installed in accordance with the manufacturer's recommendations and procedures as set forth in the installation manual furnished by the manufacturer.

B. Installation shall be scheduled such that one unit, existing or new, is available for service at all times.

3.04 INSTALLATION SUPERVISION, START-UP, AND OPERATOR TRAINING

F. Upon complete installation of equipment by the Contractor, including placement of equipment, setting and leveling the equipment, piping and electrical connections to all the equipment specified herein, the manufacturer's service representative will approve the installation and begin start up and training.

G. Upon approval of the installation, the services of the manufacturer's factory trained representative shall be provided at the project site for equipment start-up and calibration. During the start-up and calibration phase the manufacturer's representative shall inspect all system components for proper connection and alignment and assist the installation contractor in placing the equipment in a proper operating condition.

H. Upon satisfactory completion of the start-up and calibration, a representative of the manufacturer shall be provided to instruct Owner's personnel in the proper operation and maintenance of the equipment.

I. All of the above sessions shall be completed in a total of one trip to the jobsite by the manufacturer's representative. The equipment manufacturer will request in writing that all installation prior to arriving at the jobsite be completed by the Contractor. If the equipment manufacturer arrives at the jobsite and equipment installation is not complete, the equipment manufacturer shall bill the Contractor at the manufacturer's standard service rates, or as agreed to at the time of the service request, and there shall be no additional cost to the Owner.

Period	Number of 8-hour days
Inspection / Start Up / Calibration / Training	1

END OF SECTION

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SECTION 11240 SLUDGE PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section shall include furnishing, unloading at the jobsite, handling, storage and installing two (2) positive displacement, single stage, progressing cavity sludge pumps, complete with ancillary equipment, as specified and indicated on the drawings for a complete and operational system as required to meet the specified performance requirements.

B. Related Sections

25. Section 11230 – Gravity Belt Thickener
26. Section 16010 – Electrical Requirements
27. Section 16122 – Motors
28. Section 16135 – Cabinets and Enclosures
29. Section 16144 – Disconnect Switches
30. Section 16262 – Variable Frequency Drives Below 75 HP
31. Section 16416 – Transient Voltage Surge Suppressors
32. Section 16422 – Motor Control
33. Section 16951 – Functional Testing
34. Section 17010 – Basic Measurement and Control Instruments
35. Section 17127 – Panel Instruments
36. Section 17411 – Control Strategies
37. Section 17442 – Instrument and Control Panels

1.02 GENERAL

Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by the engineer.

1.03 SUBMITTALS

F. Submittals shall be in accordance with Section 01340 Shop Drawings, Project Data and Samples.

G. Sludge Pumps

1. Submit documentation of manufacturer's experience.
2. Submit complete pump drawings, together with, wiring diagrams and controls for review by the ENGINEER.
3. Submit the following information for approval before equipment is fabricated:
   a. Drawings showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all equipment and sufficient information to allow the ENGINEER to check clearances, connections, and conformance with the specifications.

b. Materials of construction of all equipment.

c. Manufacturer's catalog data, operating literature, specifications, performance and calibration curves for pumps, and auxiliary components.

d. Complete instrumentation, control, logic and power wiring diagrams in sufficient detail to allow installation of the instrumentation, controls, and electrical components.

4. Manuals

a. Furnish manufacturer's installation, operation, and maintenance recommendations, bulletins, and spare parts lists.

1.04 WORKMANSHIP AND DESIGN

All components of the sludge pumps shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy adjustment or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.

1.05 MATERIALS

All materials used in the construction of the sludge pumps shall be of the best quality and entirely suitable in every respect for the service required. Materials shall conform to the ASTM Specifications where such specifications exist; the use of such materials shall be based on continuous and successful use under similar conditions of service.

1.06 QUALITY ASSURANCE

Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The equipment shall be supplied by a firm which has been regularly engaged in the design, fabrication, assembly, testing, start-up and service of pumps of the same model and size as proposed, operating in the U.S., with similar sludges, for a period of not less than ten (10) years prior to the bid date of this contract, with a minimum of 20 installations. The bidder shall submit data to substantiate the manufacturers experience in accordance with the contract documents.

1.07 WARRANTY

The Manufacturer shall warrant in writing that all equipment supplied by them shall be free from defects in material and workmanship in accordance with Part 1.13 of Section 01030 Special Project Procedures.

1.08 CONDITIONS OF SERVICE

A. The sludge pumps shall be designed to transfer sludge from the holding tanks to the gravity belt thickener, from the gravity belt thickener to the holding tanks, and from the holding tanks to the belt filter presses as required by facility operators. Each unit shall be designed to operate in the environment for which it is intended, continuously or intermittently, on demand.

B. Operating conditions are:

Fluid Being Pumped	Waste Activated Sludge
Feed Solids, percent d.w.s.	1.0 to 5.0
Hydraulic Capacity, g.p.m.	125

Total Dynamic Head, ft	50
Pump Speed, rpm	280

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

Each sludge pumping unit shall be complete and functional for its intended purpose, including, but not be limited to, one progressing cavity pump assembly with single mechanical seal, horizontally oriented suction, carbon steel piggy back style break bent base with anchor holes, belt and pulley assembly, belt guard, motor, and water supply for seal flushing. Should equipment other than that specified be proposed by the Contractor, the Contractor shall be responsible for any redesign based on the requirements contained herein.

2.02 SYSTEM COMPONENTS

A. Pump

1. Pump shall be cradle-mounted to allow normally vertical suction port to be rotated to any angle perpendicular to centerline to facilitate piping connections.
2. Bearing and suction housings of pump shall be thick-walled cast iron. All cast parts shall be free of sand holes, blow holes and other defects. Suction housing shall incorporate two rectangular inspection ports, 180 deg. apart, to permit access to suction housing interior without disconnecting piping.
3. Bearings must be integral to pump and of grease lubricated, tapered roller type with diverging pressure angles for maximum shaft stability. Close-coupled pumps, which do not utilize bearings integral to pump, will not be accepted. Bearings are to be designed for minimum B-10 life of 100,000 hours under maximum operating conditions and will not require periodic lubrication. Bearings shall be protected from contaminants by means of a bearing cover plate bolted to bearing housing. Bearings shall be enclosed in a separate housing, incorporating a bearing spacer and bolted bearing cover, which eliminates the need to shim bearings. Inferior methods of positioning bearings, i.e., snap rings, will not be accepted.
4. Rotor shall be of one-piece construction with integrally machined rotor head. Rotors made in long lengths, cut to size with welded rotor heads will not be accepted.
5. Rotor shall be machined from alloy steel. The alloy steel shall be ASTM A331-90, grade 4150 cold finish with yield strength greater than 55,000 psi. Rotor shall be single helix design with hard chrome plate thickness of .010 inches (or other high velocity thermal deposition applied coating) for maximum abrasion resistance.
6. Stator shall be of double helix design and chemically bonded to inside of carbon steel tube. The Shore A durometer of nitrile stator shall be 71 + 4. Stator shall be machined with grooves to accept a 720 deg. retaining ring. Stator shall be fastened to suction housing and discharge flange with removable clamp rings to facilitate stator removal. Stators held in place with other methods, such as tie rods that are prone to uneven tensioning and stator misalignment, will not be accepted.
7. Replaceable stator gaskets shall be designed to prevent material being pumped from contacting stator bonding and tube. Stators manufactured with seals integrally molded to stator elastomer, that can be damaged during handling and installation and are not replaceable, will not be accepted.
8. Stators for progressing cavity pump shall be manufactured to size. Stators made in long lengths and cut to size will not be accepted.

9. Stator tensioning or adjusting devices, which distort rotor/stator compression and seal lines will not be accepted.
10. Connecting rod shall be of rigid, splined design, connecting gear joints of drive shaft and eccentrically moving rotor. Connecting rod shall pass through shaft seal area inside hollow drive shaft quill so no eccentric loads are imparted on shaft seal area.
11. Connecting rod shall be machined of alloy steel. Alloy steel shall be ASTM 331-90, grade A8620. Connecting rod shall be splined to accept a ball gear. All diameters of connecting rod are to be concentric to within plus/minus .003" TIR. Total angularity of connecting rod shall not exceed 1.5 deg.
12. Gear joints shall be of grease lubricated crowned gear type, totally enclosed and protected by a wire reinforced elastomeric seal. Mechanical components of gear joints shall be designed to operate for 10,000 hours at manufacturer's published maximum speeds and pressures.
13. Gear joints shall be machined of alloy steel, ASTM 331-90, grade A8620. Ball gear shall have an internal spline machined to American Standard 30 deg. pressure angle involute spline. Stub tooth gears must have a 30 deg. pressure angle.
14. Joints utilized in progressing cavity pump must have separate components handling thrust forces and rotational forces. In gear joint, ball and ring gears handle rotational forces and thrust plate handles thrust forces. Light duty universal joint designs, such as flexishafts, cardan joints and bushed pin joints, with forces concentrated on line contact, will not be accepted.
15. Drive shaft shall be of hollow shaft quill design minimizing pump length and cantilever forces on shaft sealing areas of non-hollow (solid) drive shaft designs. Hollow drive shaft shall be of two-piece construction with removable stub shaft and one-piece hollow construction through bearings and shaft seal area. Stub shaft shall permit disassembly of universal joints without effecting shaft seal area. Drive shaft shall be machined from carbon steel, ASTM A519-90, grade MT1020 with yield strength of 32,000 psi.
16. Carbon steel shafts shall be coated with hard chrome plating with nominal chrome plate thickness of .010 inches for maximum abrasion resistance. Progressing cavity design that do not protect drive shaft from abrasive wear with chrome plating will not be accepted.
17. Stuffing box shall be equipped with single RO FlowServe mechanical seal.
18. The pump shall be Model 2000 G1 as manufactured by Moyno, Inc., or equal approved by the Owner.

B. Motor

The motor shall be minimum 10 HP, 1160 RPM, TEFC, inverter duty, premium efficiency, with a 1.15 service factor, suitable for operation with a variable frequency drive. The motor shall operate on 3-phase, 60 Hz, 460-volt power. Refer to Section 16262 for the variable frequency drive.

2.03 CONTROL SYSTEMS

A. Sludge Transfer Pump (Pump No. 5)

1. See specifications in division 16 for electrical power requirements, including safety disconnect switch and required local control station adjacent to the pump.
2. See specifications in Division 17 for pump control requirements, including requirements for pump's seal water solenoid, seal water flow switch, pressure

switch, pressure gauges, and control strategies for manual and automatic operation.

B. Thickener Discharge Pump (Pump No. 8)

1. See specifications in division 16 for electrical power requirements, including safety disconnect switch and required local control station adjacent to the pump.
2. See specifications in Division 17 for pump control requirements, including requirements for pump's seal water solenoid, seal water flow switch, pressure switch, pressure gauges, and control strategies for manual and automatic operation.

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C. Components

See Divisions 16 and 17.

2.04SPARE PARTS

Spare parts, as recommended by the pump manufacturer, shall be provided for each pump.

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING

A. Equipment shall be packaged for shipment and handling to prevent physical and environmental damage.

B. Equipment shall be transported to the jobsite using the manufacturer's customary method of shipment.

C. Equipment shall be off-loaded in accordance with the manufacturer's recommendations.

3.02 STORAGE

A. All equipment shall be stored in accordance with the manufacturer's written instructions.

B. Equipment shall not be stored on the ground. Equipment shall be placed on cribbing, or otherwise stored off the ground.

C. Special provisions, as directed by the manufacturer, shall be made for storage in excess of three months.

3.03 INSTALLATION

Equipment shall be installed in accordance with the manufacturer's recommendations and procedures as set forth in the installation manual furnished by the manufacturer.

3.04 INSTALLATION SUPERVISION, START-UP, AND OPERATOR TRAINING

A. Services of the manufacturer's factory trained representative, who is specifically knowledgeable in the type of equipment specified herein, shall be provided during the equipment installation period. Upon complete installation of equipment by the Contractor,

including placement of equipment, setting and leveling the equipment, piping and electrical connections to all the equipment specified herein, the manufacturer’s service representative will approve the installation and begin start up and training.

B. Upon approval of the installation, the services of the manufacturer's factory trained representative shall be provided at the project site for equipment start-up and calibration. During the start-up and calibration phase the manufacturer's representative shall inspect all system components for proper connection and alignment and assist the installation contractor in placing the equipment in a proper operating condition.

C. Upon satisfactory completion of the start-up and calibration, a representative of the manufacturer shall be provided to instruct Owner's personnel in the proper operation and maintenance of the equipment. The manufacturer's representative who will be providing the instruction shall have prior operation, maintenance and instructing experience acceptable to the Engineer. The contractor shall submit the individual's name and qualifications to the Engineer for approval at least one week prior to the scheduled operating and maintenance instruction sessions. The number of days listed below for services of the manufacturer's factory trained representative shall be provided when requested by the Owner or the Engineer during the contract period.

D. All of the above sessions shall be completed in a total of one trip to the jobsite by the manufacturer’s representative. The equipment manufacturer will request in writing that all installation prior to arriving at the jobsite be completed by the Contractor. If the equipment manufacturer arrives at the jobsite and equipment installation is not complete, the equipment manufacturer shall bill the Contractor at the manufacturer's standard service rates, or as agreed to at the time of the service request, and there shall be no additional cost to the Owner.

Period	Number of 8-hour days
Inspection, Start Up, Calibration and Operator Training	1

END OF SECTION

SECTION 11245 COARSE BUBBLE DIFFUSERS

PART 1 GENERAL

1.01 SCOPE OF WORK

This section shall include furnishing, unloading at the jobsite, handling, storing and installing coarse bubble diffusers to replace the existing diffusers in the two sludge holding tanks. The aeration manufacturer shall supply diffuser assemblies, equipped with elastomer nozzle, PVC reducer bushing, and ¾" stainless steel 45° elbow and NPT nipple pre-assembled and ready for installation.

1.02 GENERAL

Equipment furnished and installed under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by the engineer.

1.03 WORKMANSHIP AND DESIGN

All components of the diffusers shall be engineered for long, continuous, and uninterrupted service. Provisions shall be made for easy adjustment or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.

1.04 MATERIALS

All materials used in the construction of the diffusers shall be of the best quality and entirely suitable in every respect for the service required.

1.05 QUALITY ASSURANCE

Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The equipment shall be supplied by a firm which has been regularly engaged in the design, fabrication, assembly, testing, start-up and service of coarse bubble diffusers, of the same model and size as proposed, operating in the U.S., with similar sludges, for a period of not less than ten (10) years prior to the bid date of this contract. The bidder shall submit data to substantiate the manufacturers experience in accordance with the contract documents.

1.06 PATENTS

The Manufacturer shall warrant that the use of the coarse bubble diffusers, in the process for which the system has been expressly designed for, will not infringe on any U.S. or foreign patents or patents pending. In the event of any claim of infringement, the manufacturer shall defend and indemnify the Owner free from any liabilities associated with the use of the patented equipment or process.

The Manufacturer shall grant to the Owner, in perpetuity, a paid-up license to use any inventions covered by patent or patents pending, owned, or controlled by the Manufacturer in the operation of the facility being constructed in conjunction with the equipment supplied under this contract.

1.07 WARRANTY

The coarse bubble diffuser assemblies shall be warranted by the aeration manufacturer against failure under design conditions in accordance with Part 1.13 of Section 01030 Special Project Procedures.

1.08 SUBMITTALS

The aeration equipment manufacturer shall supply to the Engineer the Certified Oxygen Transfer Curve for the applied coarse bubble diffuser.

The aeration equipment manufacturer shall supply to the Engineer the Certified Diffuser Headloss Curve for the applied coarse bubble diffuser.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

Non-clogging coarse bubble diffusers of the duckbill type. Diffusers are to be installed on existing air piping at the bottom of two sludge holding tanks.

2.02 MANUFACTURER

Diffusers shall be as manufactured by Tideflex Technologies (A Division of Red Valve Company), Pittsburgh, PA, or approved alternate.

The Tideflex diffuser model shall be the following;

> Tideflex Model TFA-3.00 with 45-degree elbow and internal closure plates
> Part Number: TFA-030-45B-6R6140 (EPDM Elastomer)

Alternate manufacturers must comply with the performance specifications of Section 2.03. Alternate diffusers cannot be duckbill type as Tideflex diffusers are patented as duckbill type.

2.03 DIFFUSER CONSTRUCTION AND PERFORMANCE

The diffuser shall be capable of preventing backflow of the process liquid into the diffuser and distribution piping through the diffuser air emittance opening when the discharge airflow is shut-off, there will be no exceptions to this requirement for any submitted alternate style diffusers.

The diffuser shall be equipped with internal stainless steel closure plates that provide positive closure of the bill opening at zero external pressure or hydrostatic head. The plates shall be totally encased in the elastomer with no visible exposure.

The diffuser shall be capable of complete submersion in a sludge blanket of minimum 3% solids concentration with zero airflow through the diffuser without causing clogging of the diffuser discharge opening or misalignment of the diffuser original orientation. The diffuser shall be capable of operating in an on-off blower operation mode without clogging of the diffuser. There will be no exceptions to this requirement.

The elastomer diffuser must be clamped to a bushing using a heavy duty clamp to ensure the diffuser will not separate from the connection during operation. The bushing shall have a ribbed or barbed end for connection to the elastomer cuff portion of the duckbill diffuser. Unrestrained elastomer components using compression fit, snap-on, and friction fit connections will not be accepted.

The assembly shall include a 304SS 45-degree elbow fitting and a ¾" NPT threaded male end. A polyester orifice plug shall be provided for insertion into the ¾" threaded end. The orifice port diameter shall be as recommended by the diffuser manufacturer for the conditions under which the diffuser is to be used inches.

All elastomer components shall be constructed of EPDM synthetic elastomer with a leachable oils content of 10% or less.

The diffuser must be capable of mounting below the elevation of the manifold piping and have perforated membrane area on the lowest point to allow for automatic purging of accumulated condensate within the manifold piping. There will be no exceptions to this requirement.

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING

Equipment shall be packaged for shipment and handling to prevent physical and environmental damage.
Equipment shall be transported to the jobsite using the manufacturer's customary method of shipment.
Equipment shall be off-loaded in accordance with the manufacturer's recommendations.

3.02 STORAGE

All equipment shall be stored in accordance with the manufacturer's written instructions.
Equipment shall not be stored on the ground. Equipment shall be placed on cribbing, or otherwise stored off the ground.
Special provisions, as directed by the manufacturer, shall be made for storage in excess of three months.

3.03 INSTALLATION

Equipment shall be installed in accordance with the manufacturer's recommendations and procedures as set forth in the installation manual furnished by the manufacturer.

The diffuser shall be capable of orienting the discharge point downward at a distance within 4" above the finish floor elevation of the tank. The emittence point of air from the diffuser shall not be greater than 4" above the tank floor for the diffusers closest to the top of slope of the floor elevation unless specified otherwise on the contract drawings.

The diffuser shall be capable of connection to the distribution pipe which shall be located with a minimum of 4" of clearance from the bottom of the pipe to the finish floor elevation.

Discharge orientation of the diffuser shall be shown on the installation drawings. The bill slit opening of the diffuser should be horizontal and parallel with the floor.

Installation of the diffuser shall be free of any obstructions within the tank that would cause the flexible end to be bent from its standard molded form.

3.04 START UP PROCEDURES

Start-up procedures shall be outlined in the Installation, Operation and Maintenance Manual provided by the aeration equipment manufacturer.

END OF SECTION

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DIVISION 15 MECHANICAL

SECTION 15094 PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals and install pipe hangers, supports, concrete inserts and anchor bolts including all metallic hanging and supporting devices for supporting exposed piping.

1.02 QUALIFICATIONS

A. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for pipe supports shall be five (5) times the ultimate tensile strength of the material.

Note: Lift Stations have their own pipe support hanger and support design and detail, shown in the Utility Standards if not shown on the plans.

B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification stating that such requirements have been complied with.

1.03 SUBMITTALS

A. Submit to the County for approval, as provided in the Contract Documents, shop drawings of all items to be furnished under this Section.

B. Submit to the County, for approval, samples of all materials specified herein.

C. All pipe hangers, supports, hanger rods, clamps, concrete inserts and wall brackets, etc., whether specified or not, shall be submitted (together with load calculations) to the County for approval, if requested.

PART 2 PRODUCTS

2.01 GENERAL

A. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. All pipe supports shall be approved prior to installation.

B. All materials used in manufacturing hangers and supports shall be capable of meeting the

respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.

C. Hangers and supports shall be spaced in accordance with ANSI B31.1.0 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified herein.

D. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by Grinnell Co., Inc., Carpenter and Patterson, Inc., or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance will be considered for approval.

2.02 PIPE HANGERS AND SUPPORTS FOR METAL PIPE

A. Suspended single pipes shall be supported by hangers suspended by steel rods from galvanized concrete inserts, beam clamps, or ceiling mounting bolts.

The following sizes are minimum requirements and are subject to the County's approval:

1. Hanger rods shall be rolled steel machine threaded with load ratings conforming to ASTM Specifications and the strength of the rod shall be based on root diameter. Hanger rods shall have the following minimum diameters:

Pipe Size, Inches	Min. Rod Diameter, In.
Less than 2-1/2	3/8
2-1/2 through 4	1/2
4	5/8
6	3/4
8-12	7/8
14-18	1
20-30	1-1/4
Above 30	See SPECIAL SUPPORTS Paragraph 2.04

2. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes 1/2-inch through 3/4-inch shall be equal to Grinnell Fig. No. 229, and for rod sizes 7/8-inch through 1-1/4 inches shall be equal to Grinnel Fig. No. 228, or equal.
3. Concrete inserts for pipe hangers shall be continuous metal inserts designed to be used in ceilings, walls or floors, spot insets for individual pipe hangers, or ceiling mounting bolts for individual pipe hangers and shall be as manufactured by Unistrut Corp., Wayne, Michigan; Carpenter and Patterson, Inc., Laconia, New Hampshire; Richmond or equal and shall be as follows:
   a. Continuous concrete inserts shall be used where applicable and/or as shown on the Drawings and shall be used for hanger rod sizes up to and including 3/4-inch diameter. Inserts to be used where supports are parallel to the main slab reinforcement shall be Series P3200 by Unistrut Corp., Fig. 1480 Type 2 by Carpenter and Patterson, Inc. or equal. Inserts to be used where supports are perpendicular to the main slab reinforcement shall be Series P3300 by Unistrut Corp., Fig. 1480 Type I by Carpenter and Patterson, Inc., or equal.
   b. Spot concrete inserts shall be used where applicable and shall be used for hanger sizes up to and including 7/8-inch diameter. Inserts shall be Fig. 650 by Carpenter and Patterson, Inc. for hanger rod sizes 1/2-inch through

and including 3/4-inch and Fig. 266 by Carpenter and Patterson, Inc., for 7/8-inch hanger rods.

c. Ceiling mounting bolts shall be used where applicable and be for hanger rod sizes 1-inch through and including 1-1/4 inches shall be Fig. 104M as manufactured by Carpenter and Patterson, Inc. or equal.

d. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall be equal to Grinnell Fig. No. 230.

4. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnell Fig. 194, 195 and 199 as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.

a. Where the pipe is located above the bracket, the pipe shall be supported by an anchor chair and U-bolt assembly supported by the bracket for pipes 4-inches and larger or by a U-bolt for pipes smaller than 4-inches. Anchor chairs shall be equal to Carpenter & Patterson Fig. 127. U-bolts shall be equal to Grinnell Fig. 120 and 137.

b. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.

c. Wall or column supported pipes 2-inches and smaller may be supported by hangers equal to Carpenter and Patterson Figures 74, 179 or 237 as required.

5. Floor supported pipes 3-inches and larger in diameter shall be supported by either cast-in-place concrete supports or adjustable pipe saddle supports as directed by the County. In general, concrete supports shall be used when lateral displacement of the pipes is probable (unless lateral support is provided), and adjustable pipe saddle type supports shall be used where lateral displacement of the pipes is not probable.

a. Each concrete support shall conform to the details shown on the Drawings. Concrete shall be poured after the pipe is in place with temporary supports. Top edges and vertical corners of each concrete support shall have 1-inch bevels. Each pipe shall be secured on each concrete support by a wrought iron or steel anchor strap anchored to the concrete with cast-in-place bolts or with expansion bolts. Where directed by the County, vertical reinforcement bars shall be grouted into drilled holes in the concrete floor to prevent overturning or lateral displacement of the concrete support. Unless otherwise approved by the County, maximum support height shall be five (5) feet.

b. Concrete piers used to support base elbows and tees shall be similar to that specified above.
Piers may be square or rectangular.

c. Each adjustable pipe saddle support shall be screwed or welded to the corresponding size 150 lb. companion flanges or slip-on welding flanges respectively. Supporting pipe shall be of Schedule 40 steel pipe construction. Each flange shall be secured to the concrete floor by a minimum of two (2) expansion bolts per flange. Adjustable saddle supports shall be equal to Grinnell Fig. No. 264. Where used under base fittings, a suitable flange shall be substituted for the saddle.

d. Floor supported pipes less than 3-inches shall be supported by fabricated steel supports.

6. Vertical piping shall be supported as follows:

a. Where pipes change from horizontal to vertical, the pipes shall be supported on the horizontal runs within two feet of the change in direction

by pipe supports as previously specified herein.

b. For vertical runs exceeding 15 feet, pipes shall be supported by approved pipe collars, clamps, brackets, or wall rests at all points required to insure a rigid installation.

c. Where vertical piping passes through a steel floor sleeve, the pipe shall be supported by a friction type pipe clamp which is supported by the pipe sleeve. Pipe clamps shall be equal to Grinnell Fig. 262.

7. Anchor bolts shall be equal to Kwik-Bolt as manufactured by Hilti Fastening Systems, Tulsa, Oklahoma or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, Colorado.

8. All rods, hangers, inserts, brackets, and components shall be furnished with galvanized finish.

2.03 PIPE HANGERS AND SUPPORTS FOR PLASTIC PIPE

A. Single plastic pipes shall be supported by pipe supports as previously specified herein.

B. Multiple, suspended, horizontal plastic pipe runs, where possible, and rubber hose shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy, the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of mild steel construction. Rung spacing shall be approximately 18 inches for plastic pipe and 12 inches for rubber nose. Tray width shall be approximately 6-inch for single runs of rubber hose and 12 inches for double runs of rubber hose. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc. required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model M-CAC, Huskey-Burndy Model SCR or equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe.

C. Individual clamps, hangers, and supports in contact plastic pipe shall provide firm support, but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

2.04 SPECIAL SUPPORTS

A. The pipes shall be supported by means of a supporting framework suitably anchored into the floor or curbing. The vertical piping shall be suitably secured to horizontal support members connected at each end to vertical support members and spaced as required to provide a rigid installation.

1. The complete supporting system shall be as manufactured by the Unistrut Corporation, Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum, or equal.

2. Vertical and horizontal supporting members shall be U-shaped channels similar to Unistrut Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps equal to Unistrut Series P1100M and Series P2558. All components shall be of mild steel.

3. The assemblies shall be furnished complete with all nuts, bolts, and fittings required for a complete assembly.

4. The design of each individual framing system shall be the responsibility of the Contractor. Shop drawings shall be submitted and shall show all details of the installation including dimensions and types of supports.

B. Any required pipe supports for which the supports specified in the Section are not applicable, including pipe supports for above 30-inch pipe, shall be fabricated or constructed from standard aluminum shapes in accordance with Specifications, concrete and anchor hardware similar to items previous specified herein and shall meet the minimum requirements listed below and be submitted to the approval of the County.

1. Pipe support systems shall meet all requirements of this Section and all related Sections of this Specification.
2. Complete design details of the entire pipe support systems shall be provided by the Contractor, for approval by the County.
3. The pipe support system shall not impose loads on the supporting structures, in excess of the loads for which the supporting structure is designed.
4. Hanger rods for above 30-inch pipe shall be a minimum of 1-1/2 inch diameter and shall not exceed the manufacturer's standard maximum recommended safe load.

C. Pipe supports in lift stations shall be as shown in the Utility Standards details.

PART 3 EXECUTION

3.01 INSTALLATION

A. All pipes, horizontal and vertical, shall be rigidly supported from the building structure by approved supports. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless it is so indicated on the Drawings, or specifically directed or authorized by the County.

B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the County.

C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces to pump housings. Pump housings shall not be utilized to support connecting pipes.

D. Pipe supports shall be provided as follows:

1. Cast iron and ductile iron shall be supported at a maximum support spacing of 10 feet-0-inches with a minimum of one support per pipe section at the joints.
2. Supports for multiple PVC pipes shall be continuous wherever possible. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support spacing shall not exceed five (5) feet.
3. Support spacing for galvanized steel pipe and copper tubing shall not exceed five (5) feet.
4. All vertical pipes shall be supported at each floor or at intervals of at least 15 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to insure rigid construction.

E. Pipe supports shall not result in point loadings, but shall distribute pipe loads evenly along the pipe circumference.

F. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.

G. Inserts for pipe hangers and supports shall be installed on forms before concrete is poured. Before setting these items, all drawings and figures shall be checked which have a direct bearing on the pipe locations. Responsibility for the proper location of pipe supports is included under this Section.

H. Continuous metal inserts shall be embedded flush with the concrete surface.

3.02 PRIME COATING

A. Prior to prime coating, all pipe hangers and supports shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint, and other foreign substances to the satisfaction of the County.

B. All submerged pipe supports shall be prime coated with TNEMEC 69-1211 Epoxy Primer or equal. All other pipe supports shall be prime coated with TNEMEC 66-1211, or equal.

C. Finish coating shall be compatible with the prime coating used and shall be applied as specified in the Contract Documents.

END OF SECTION

DIVISION 16 ELECTRICAL

SECTION 16010 ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Electrical additions to existing distribution system and utilization equipment.

1. Electrical installation and connection of equipment furnished requires electric power and control.
2. Provide underground conduit systems, and concrete pullboxes indicated on the Drawings.
3. Disconnect and remove, relocate, and reconnect electrical equipment as specified and necessary for complete function of process equipment.
4. Provide new electrical panels, modify and add circuits and circuit breakers to existing electrical panels, and provide other electrical equipment as specified in other sections and as indicated on the Drawings.
5. Coordinate with Supplier of Sludge Thickener No. 2 equipment and provide necessary power and controls conduits and wiring, according to equipment shop drawings for complete functioning of the sludge thickening process.
6. Coordinate with Supplier of new Polymer equipment and provide necessary power and controls conduits and wiring, according to equipment shop drawings for complete functioning of the polymer process.
7. Coordinate with Supplier of new sludge feed pump and thickened sludge discharge pump equipment and provide necessary power and controls conduits and wiring, according to equipment shop drawings for complete functioning of the pumps.
8. Demolish existing equipment and underground electrical conduits, and remove existing wiring for buildings or structures required to be remodel or upgraded.

B. Electrical Constraints:

1. Protect and prevent damage to existing underground piping utilities and electrical utilities associated with remaining process equipment, during construction of new underground utilities.
2. Existing motor control center and panelboard modifications:
   a. Maintain existing electrical panels in continues operation during connection of new power feeders associated with new sludge thickener process.
   b. Coordinate temporary shutdown of power to existing motor control centers and panelboards and provide continuous power for continuous plant operation.
      1) Constraints During Momentary Shutdown of power to existing process equipment:
         a) Provide and verify proper functioning of temporary power
      2) Indicate shutdown of main electric power on Progress Schedule. Shutdowns will be permitted to the extent that existing operation of

the plant will not be jeopardized and identified constraints are satisfied.

3. Existing Electric Room in Blower Building No.3 and Electrical System Modifications:
   a. Coordinate with plant operators the momentary power shutdowns of MCC-7 and MCC-8 for additions of new wiring.
4. Existing Instrumentation System Modifications:
   a. Coordinate with plant operators the additional PLC items interconnected with existing SCADA network, and avoid interruption of SCADA system.

1.02 SYSTEM DESCRIPTION

A. Furnish and install a tested and working electrical system, as indicated on the Drawings and as specified. System includes all items not specifically mentioned in these Specifications or indicated on the Drawings or accepted Shop Drawings, but which are obviously necessary to make a complete working installation, and shall be deemed to be included herein.

B. Notify ENGINEER of discrepancies within the Contract Documents and discrepancies between the Contract Documents and actual field conditions.

C. The Specifications and Drawings indicate or specify minimum sizes of equipment, electric devices, and other components of electrical system, but the Specifications and Drawings do not indicate every offset and fitting, or every structural or mechanical difficulty that may be encountered during the execution of the Work.

D. Install equipment at locations indicated on the Drawings as closely as field conditions permit. Obtain accepted equipment submittal dimensions prior to installing pads, and conduits.

E. Make minor variations to alignment of equipment and/or installation of raceway systems to avoid conflict with other portions of the Work.

F. Single Line Diagrams: Single line diagrams and block diagrams indicate circuit voltages for low voltage equipment, also indicate some wire and conduit sizes, circuit protection rating, and other pertinent data.

1. When not indicated on the Drawings, provide grounding in accordance with NEC Article 250 and as specified in Section 16062.

G. Electrical Utility Services:

1. The electrical utility service for the Southeast Water Reclamation Facility is existing and it shall remain as is and without interruption.

H. Temporary Power:

1. Provide and maintain temporary power, lighting, and telephone systems as needed for construction as required. Include weatherproof panel(s) for main breakers and electrical power distribution system.

2. Install temporary wiring in accordance with NEC Article 305 with Type SO portable cable, watertight connections, and ground fault interrupting equipment.
3. Provide temporary power and controls for the existing thickener process equipment, due to possible impact to underground wiring system during excavation and construction of piping and conduits associated with new sludge thickener No. 2.
4. Provide temporary power and conduits for Internet or telephone system at the Construction -office trailers.
5. After construction is completed, remove temporary power and control systems.

1.03 PERFORMANCE REQUIREMENTS

A. Operate electrical equipment successfully at full-rated load, without failure, at an ambient air temperature of 40 degrees Celsius, and rated for an altitude of 100 feet.

B. Coordination of Electrical Equipment Rating: Verify actual equipment, motor full-load, and locked-rotor current ratings. When providing equipment with different motor full-load and locked-rotor current ratings than indicated on the Drawings, coordinate branch circuit conductor sizes, motor overload protection, motor controllers, control power transformers, and branch circuit overcurrent protection required for equipment provided.

C. Branch Circuit Conductor Current Carrying Capacity: Minimum 125 percent of the full-load current rating of equipment.

D. Branch Circuit Conductor Size: Adequate to prevent voltage drop greater than 2 percent from branch circuit protection device to equipment with equipment running at full-load and rated voltage. Include conductor derating in accordance with ambient temperature and conduit fill requirements.

E. Motor Running Overload Protection Devices:

1. Rated or selected to trip at no more than the following percent of motor nameplate full-load current rating:
   a. 125 percent for motors with marked service factor not less than 1.15.
   b. 125 percent for motors with marked temperature rise not over 40 degrees Celsius.
   c. 115 percent for all other motors.
2. Size and provide upon verification of actual motor or nameplate data.
3. Where power factor correction capacitors are provided on load side of motor running overload protection device, selection or setting shall be based on the improved power factor of motor circuit and not the full-load nameplate current of motors.

F. Overload Heaters Required for Motors with Temperature Rise of 50 Degrees Celsius: As selected from motor controller manufacturer's overload heater selection tables.

G. Motor Controller Size: Coordinated with horsepower size of motor.

H. Motor-Branch-Circuit Short Circuit and Ground Fault Protections Device: Capable of tripping open in 30 seconds or less on locked-rotor current of motor. This device shall also protect the motor-branch-circuit conductors and the motor control apparatus against

overcurrent due to short-circuit or ground faults. Protect motor control circuits with device type specified or as indicated on the Drawings.

1.04 SUBMITTALS

A. Shop Drawings and Product Data:

1. Include data on and details of control devices, fixtures, wire, cables, raceways, and other electrical equipment specified or indicated on the Drawings.
2. Include protective device coordination study, short circuit fault analysis, circuit breaker settings, and other calculations and studies as specified.
3. Detailed schematic diagrams for control equipment. Schematic diagrams to show existing wiring.
4. Point-to-point interconnection diagrams, for all devices.
5. Calibration and testing forms.
6. Loop diagrams.
7. Conduit and raceway submittal drawings for lighting and receptacles, etc.
8. Factory testing procedures.
9. Functional testing plan.
10. Training plan for plant staff.

B. Project Record Documents:

1. Include drawings of wiring terminations at electrical equipment including, but not limited to:
    a. Terminal/junction boxes.
    b. Revised Shop Drawings reflecting modifications made during progress of the Work including testing, and revised Specifications and Drawings with conductors identified identically as on the Specifications and Drawings and accepted Shop Drawings. Updated Shop Drawings shall include all drafting work.

C. Acceptance Testing Information and Documents: Submit as specified in Section 16950 and 16951.

D. Operating and Maintenance Data (Electrical Equipment):

1. Manuals shall include the following:
    a. Comprehensive index.
    b. Complete “as-built” set of approved shop drawings.
    c. Internal and interconnecting CAD-generated wiring and control diagrams with data to explain detailed operation and control of the equipment. Diagrams shall contain tabulated “as left” settings for all timing relays and alarm and trip setpoints.
    d. A control sequence describing startup, operation and shutdown for all equipment functional modes as applicable (i.e., LOCAL-MANUAL, LOCAL-AUTOMATIC, REMOTE-MANUAL, REMOTE AUTOMATIC, etc.).
    e. Description of the function of each principal item of equipment.
    f. Installation and maintenance instructions.
    g. Safety precautions.
    h. Diagrams and illustrations.
    i. Testing methods.

j. Performance data.

k. Pictorial “exploded” parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.

l. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

m. Provide operations and maintenance (O&M) manuals in electronic format on CD, provide in Adobe Acrobat format or Microsoft Word Format. Documents not originally in digital form shall be scanned at 300 dpi, content being the same as the hard copy O&M manuals.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Perform electrical work, including connection to electrical equipment integral with mechanical equipment, in accordance with latest published requirements of the following codes and code/standard making organizations:

1. American National Standards Institute (ANSI).
2. American Society for Testing and Materials (ASTM).
3. Institute of Electrical and Electronics Engineers (IEEE).
4. Insulated Cable Engineers Association (ICEA).
5. National Electrical Code (NEC).
6. National Electrical Contractors Association (NECA).
7. National Electrical Safety Code (NESC).
8. National Electrical Manufacturers Association (NEMA).
9. National Fire Protection Association (NFPA).
10. National Fire Protection Association (NFPA); Standard for Fire Protection in Wastewater Treatment and Collection Facilities (NFPA-820).
11. State of Florida Building Code and local codes.

B. When applicable, materials and equipment used in performance of electrical work shall be listed or labeled by Underwriters' Laboratories or other equivalent, recognized, and independent testing laboratory, for the class of service intended.

C. Manufacturer Qualifications:

1. Low Voltage Equipment: Manufacturer of proposed product with components uniquely selected by engineering review.
   a. Proprietary bussing and enclosure designs listed by UL in manufacturer's own file for minimum 15 years with satisfactory performance record.
   b. Capable of providing warranty for assembly when built-up with components from various manufacturers.

D. Implementation of Protective Device Studies: Have qualified independent testing service implement recommended settings defined in accepted coordination study for protective devices such as relays, fuses, and circuit breakers as specified in Section 16950. The OWNER will withhold payment for the electrical equipment protected by the devices until the studies are accepted and the results are implemented.

E. Experience and Requirements for Electrical Subcontractor: The electrical work in Division 16 of the specifications shall be furnished and installed by a single electrical and controls specialty entity (or electrical subcontractor) with at least 10 years of prior experience in electrical construction project for the water and/or wastewater process industry.

1. The electrical contracting entity shall have a specialty active license in the State of Florida.
2. The firm shall have completed at least 5 projects in the last 5 years of similar or larger scope of work for wastewater related projects.
3. The supervising personnel shall have at least 10 years of prior field hands on electrical experience in projects of similar or larger electrical scope of construction work.
4. Upon request from the Construction Administrator, the CONTRACTOR shall submit the qualifications of the electrical specialty firm or electrical subcontractor, including at least five (5) previous electrical projects, with a reference, names, and telephone numbers of the OWNERs for the previous projects. Also, upon request submit the resumes of the key supervising and electrical personnel who will perform the electrical work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ship electrical panels, switchboards, motor control centers, and other electrical distribution equipment in sealed dust and moisture-proof plastic sheet enclosures. Equipment containing dirt, dust, water, grease, rust, or damaged parts or components may be rejected.

B. Provide for delivery, unloading, transportation, and storage of equipment until installation. Protect electrical and instrumentation equipment and panels from physical and environmental damage. Store and maintain equipment in a weatherproof building until installed.

C. Store electrical equipment, including switchboard, motor control center, instrumentation control panels, and other enclosures that house electronic equipment rated for a specified ambient or environmental temperature range, in air conditioned buildings to protect equipment from temperatures above 90 degrees Fahrenheit and heated buildings to protect equipment from temperatures below 40 degrees Fahrenheit. Assume liability for the storage facilities or equipment stored therein.

D. Maintain storage facilities in neat condition with utilities. Maintain stored equipment in same condition as when received.

E. Provide continuous access for inspection of stored equipment.

1.07 HAZARDOUS AREAS

A. Headworks Structure:

1. Comply with the requirements of the Standard for Fire Protection in Wastewater Treatment and Collection Facilities (NFPA 820).

1.08 SEQUENCING AND SCHEDULING

A. Coordinate work with ENGINEER to minimize downtime of existing operating equipment and electrical distribution system and to preclude unsafe operations. Notify OWNER 10 days prior to power interruptions. Coordinate downtime with OWNER.

B. Prior to performing work on live or energized electrical equipment, or in underground pull boxes or manholes containing energized circuits, identify the circuits and coordinate with Owner prior to de-energize the circuits. Also, provide necessary safety protection in accordance with Electrical Life Safety Code and OSHA requirements if work needs to be momentarily performed with energized circuits.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 PREPARATION

A. Cutting, Patching and Repairing: Where it becomes necessary to cut into existing work for the purpose of making electrical installations, use core drills for making circular holes. Other demolition methods for cutting or removing shall be reviewed by the ENGINEER prior to starting the work.

3.02 INSTALLATION

A. Corrosion Protection:

1. Isolate dissimilar metals, except conduit and conduit fittings, that may come in contact, with neoprene washers, 9 mil polyethylene tape, or gaskets.
2. Restore factory finishes which are damaged or rusted to their original new condition in accordance with manufacturer's instructions.

B. Install electrical work prior to placing floors and walls. Provide all sleeves and openings through floors and walls required for passage of all conduits and other raceways. Sleeves shall be rigidly supported and suitably packed or sealed to prevent ingress of wet concrete or water.

C. Provide all insets and hangers required to support raceways and other electrical equipment. If the inserts, hangers, sleeves, or openings, are improperly placed or installed, do all necessary work to rectify the errors.

3.03 CLEANING

A. Clean each piece of electrical equipment, existing and new, both inside and outside, paint each equipment if necessary to match existing paint.

3.04 PROTECTION

A. Protect products in outdoor locations or air heated areas and provide heat to eliminate condensation until acceptance by OWNER.

END OF SECTION

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SECTION 16050 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Basic electrical materials and methods.

1.02 REFERENCES

A. American Society for Testing Materials (ASTM):

1. A 525 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized), by Hot-Dip Process.

B. National Electrical Manufacturers' Association (NEMA).

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Connections of electrical equipment to supports shall be designed to resist the operating forces plus windload forces.

1.04 SUBMITTALS

A. Structural calculations for electrical equipment anchorage.

B. Shop drawings and product data.

1.05 WARRANTY

A. Submit manufacturer's standard warranty.

1.06 EXTRA MATERIALS

A. Furnish and install a minimum of 25 percent spare terminal blocks in each terminal/junction box.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Unless specified otherwise indicated on the Drawings, the fabricator of major electrical equipment, such as lighting and distribution panelboards, and motor control centers, shall also be the manufacturer of the major devices herein.

2.02 MATERIALS

A. Materials, equipment, and parts comprising any unit or part thereof specified or indicated on the Drawings shall be new and unused, of current manufacture, and of highest grade consistent with the industrial industry standards. Damaged materials, equipment, and parts are not considered to be new and unused and will not be accepted.

2.03 EQUIPMENT

A. Support Channels: Stainless steel No. 316 for corrosive locations.

1. Manufacturers: One of the following or equal:
   a. Unistrut.
   b. Superstrut.
   c. Globe Strut.

B. Support Channel Bolts, Nuts, and Washers: 316 Stainless steel.

C. Non-Fused Terminal Blocks: Sized as required for conductors.

1. Manufacturers: One of the following or equal:
   a. Square D Company.
   b. Buchanan.

D. Fused Terminal Blocks: Circuit isolation, fused switch type, sized as required for conductors. Fuse size shall be based upon actual load and conductors to be protected.

1. Manufacturers: One of the following or equal:
   a. Square D Company.
   b. Buchanan.

E. Control Relays:

1. Industrial 600 volt, 10 ampere type with contact arrangement and operating coils of proper voltage as required by control circuit sequence; with minimum of 4 reversible-pole contacts; coils sealed by pressure molding.
2. Non-industrial or plug-in type control relays shall be prohibited unless accepted in writing.
3. Manufacturers: One of the following or equal:
   a. Square D Company.
   b. Cutler-Hammer.

F. Intrinsically Safe Relays:

1. Factory Mutual approved to allow the use of every type of remote pilot device located in Class 1, Division 1 or 2, hazardous areas by providing a pilot circuit incapable of releasing sufficient electrical energy to ignite gases and vapors classified in Groups A, B, C, and D.
2. Output relay with double pole, double throw contacts continuous rating of 10 amperes at 120 volts alternating current, capable of operating on the voltage indicated.
3. Manufacturers: One of the following or equal:

a. B/W - Controls Series 53.
b. Cutler-Hammer - Powered Relay.

G. Reset Timers and Repeat Cycle Timers:

1. Industrial type; 120 volts alternating current, 60 hertz operating power; 6 amperes minimum at 120 volts alternating current output unless otherwise indicated on the Drawings or specified.
2. In enclosure as indicated on the Drawings or specified; plug-in or non-industrial timers shall be prohibited unless accepted in writing.
3. Manufacturers: One of the following or equal:
   a. Eagle.
   b. Paragon.

H. Twenty-Four Hour Timers:

1. Heavy-duty industrial, 120 volts, 60 hertz alternating current operating power, electronic type; 15 amperes at 120 volts alternating current output, single channel type; lithium battery-backed; single pole double throw.
2. In enclosure; plug-in or non-industrial timers shall be prohibited unless accepted in writing.
3. Manufacturers: One of the following or equal:
   a. Paragon, EC Series
   b. Tork, equivalent model.

I. Timing Relays: Heavy-duty industrial, 600 volt, 10 amperes.

1. Manufacturers: One of the following or equal:
   a. Square D Company.
   b. Cutler-Hammer.

J. Area Lighting Control Timers:

1. Electromechanical type; astronomic dial to automatically turn lights ON at dusk and OFF at dawn with day omitting device; with DPST contacts rated for 40 amperes per pole; 120 volts, 60 hertz alternating current operating power.
2. Housed in a NEMA 1 enclosure. Plug-in or non-industrial timers shall be prohibited unless accepted in writing. The timers shall be Z series.
3. Manufacturers: One of the following or equal:
   a. Tork.
   b. Paragon.
   c. PCI Industries.

K. Buzzers: Capable of producing an adjustable audible sound which shall be minimum 70 decibels at 10 feet from the buzzer.

1. Manufacturers: One of the following or equal:
   a. Edwards Signaling.
   b. Federal Signal.

L. Alarm Horns: Capable of producing an adjustable audible sound which shall be minimum 100 decibels at 10 feet from the horn, accepting up to 8 different plug-in tone modules,

and having distinct tones so no 2 horns have the same tone; receiving 120 volt power from its respective control panel as specified or as indicated on the Drawings.

1. Manufacturers: One of the following or equal:
   a. Edwards Signaling.
   b. Federal Signal.

M. Siren (Horn) with Revolving Lights:

1. Weatherproof siren (horn) suitable for surface mounting, 120 V, adjustable volume, and minimum of 4 selectable tones.
2. Revolving lights, weatherproof, suitable for surface water.
3. Manufacturers: To match existing:
   a. Siren (horn):
      1) Edwards Adaptatone Signal Multi-tone Four Tone Select No. 5823T22.
   b. Revolving Light:
      2) Edwards Tri-Beam Revolving Light with Permanent Model No. 5846T53.

N. Thermostats: Unless otherwise specified elsewhere in the Contract Documents, the thermostats shall be:

1. Heavy-duty type with full load rating of 120 volts, 16 amps.
2. Provided with a clear plastic splash-proof protective thermostat cover to inhibit corrosion and moisture damage.
3. Manufacturers: One of the following or equal:
   a. Honeywell, T6051 Series.
   b. Rockwell, equivalent.

O. Warning Lights:

1. Warning rotating lights, 40 watt, suitable for indoor and outdoor use, corrosive environment.
2. Red color lens.
3. Shall direct light in a 360 degree pattern.
4. With all necessary accessories for wall-mounting or as specified otherwise elsewhere in these Contract Documents.
5. Voltage: To match the equipment requirements.
6. Manufacturers: One of the following or equal:
   a. Federal Signal Model 121.
   b. Edwards Signaling equivalent.

P. Nameplates:

1. Type: Black lamicoid with white letters.
2. Fastener: Round head stainless steel screws.

Q. Automatic Equipment and High Voltage Warning Signs:

1. Type: Suitable for exterior use and meeting OSHA regulations.

R. Medium Voltage Circuit Raceway Labels: Vinyl plastic.

1. Manufacturers: One of the following or equal:
   a. Brady.
   b. Seton.

S. Underground Hazard Tape: 6 inches wide.

1. Manufacturers: One of the following or equal:
   a. Panduit.

T. Cable Ties:

1. Tefzel Plenum-rated cable ties (or equal), sized appropriately to the conditions. Install at 4 foot maximum intervals, roughly centered between hangers, and at other appropriate locations to keep the wire groups neat.

PART 3 EXECUTION

3.01 GENERAL

A. Verify dimensions indicated on the Drawings. Actual locations, distances, and levels will be governed by actual field conditions. The CONTRACTOR shall also review information indicated on the Drawings for architectural, structural, yard, mechanical, and other specialties, and the accepted electrical and mechanical shop drawings, and shall adjust his work to conform to all conditions indicated thereon.

B. Coordinate for consistency lens colors of all pilot lights included in all equipment assemblies specified in Divisions 11 through 17 (subject to ENGINEER's acceptance).

3.02 EQUIPMENT INSTALLATION

A. Anchor electrical equipment to building floors, electrical equipment foundations, or other supports by bolts and anchor bolts and studs.

B. Anchor electrical equipment with concrete anchors or flush shells only when indicated on the Drawings.

C. Anchor each piece of electrical equipment with minimum 1/2 inch diameter Type 316 stainless steel bolts, anchor bolts, or studs. Acceptable connectors shall be furnished in each corner of each section of electrical equipment, minimum.

D. Where plates are embedded in concrete supporting electrical equipment, fasten electrical equipment to the embedded plates with minimum 1/2 inch diameter welded studs. Where required, the number of studs connecting the embedded plates to floors shall be increased as required based upon the calculations of seismic forces in order to resist the forces from the electrical equipment supplied. The additional studs shall be deemed as part of these Contract Documents.

3.03 TORQUING

A. After installing and before energizing electrical equipment, torque each bolted bus and cable connection in accordance with manufacturer's recommendations with calibrated torque wrenches. Include each bolt at each connection, both factory and field installed, for motor control centers, variable frequency drives, bus ducts, switchgear, switchboards, and other equipment installed.

3.04 CONDUCTOR FASTENERS

A. Use screw type conductor fasteners and other permanent, such as epoxy conductor adhesives, in junction or pull boxes, termination cabinets, panels, panelboards, switchboards, switchgear, motor control centers, variable frequency drives, or other enclosures containing electrical devices and/or conductors. Do not use glue-on type conductor fasteners.

3.05 SUPPORT CHANNELS

A. Install channels, as required for support of raceways, cable trays, device enclosures, and other electrical equipment.

B. Separate iron or steel supports from aluminum with 1/4 inch neoprene or other non-metallic gaskets.

C. Paint field cuts and scratches of galvanized steel channels with a cold galvanizing spray paint.

3.06 TERMINAL BLOCKS

A. Furnish and install terminal blocks in control panels, cabinets, terminal/junction boxes, variable frequency drives, motor control centers, switchgear and similar equipment and identify the terminal blocks by numbering and labeling in accordance with accepted shop drawings. The terminal blocks shall be circuit isolation fused-switch type where indicated on the Drawings and as required.

3.07 NAMEPLATES

A. Furnish and install nameplates where indicated on the Drawings or specified.

B. Each disconnect means for service, feeder, branch, or equipment conductors and push-button stations shall have nameplates indicating its purpose or identifying the load.

3.08 AUTOMATIC EQUIPMENT WARNING AND HIGH VOLTAGE SIGNS

A. Mount permanent warning signs at mechanical equipment which may be started automatically or from remote locations. Fasten warning signs with round head stainless steel screws or bolts, located and mounted in a manner acceptable to ENGINEER.

B. Mount permanent and conspicuous warning signs on (front and back) equipment, doorways to equipment rooms, pull boxes, manholes, where the voltage exceeds 600 volts.

C. Place a warning ribbon or other effective means suitable for conditions above underground installations in accordance with NEC. Place warning signs on utilization equipment that has more than one source of power. Provide panel and circuit number of conductor tag of the power source disconnect.

D. Place warning signs on utilization equipment that has 120 VAC control voltage source used for interlocking. Provide panel, circuit number, and conductor tag of control voltage source disconnect.

3.09 ADJUSTING

A. Adjust, set timers and contacts for proper equipment operation.

3.10 DEMONSTRATION

A. Demonstrate operation of equipment.

END OF SECTION

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SECTION 16062 GROUNDING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Grounding electrode systems, consisting of concrete encased bare ground conductors, ground wells and ground rods.

1.02 REFERENCES

A. National Electrical Code (NEC), Article 250 - Grounding.

PART 2 PRODUCTS

2.01 MATERIALS

A. Driven Ground Rods:

1. Copper-covered steel.
2. 3/4 inch diameter.
3. 10 feet long, minimum.

B. Ground Conductor: Bare copper.

C. Precast Ground Wells: Eight inch inside diameter, minimum, with cast iron cover.

1. Manufacturers: one of the following or equal:
   a. Oldcastle Precast
   b. Christy, valve boxes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide grounding for new pumps, related metallic piping, new sludge thickener process equipment, control panels, instruments and metallic columns of structural canopy.

B. Provide concrete encased bare ground conductor in each underground duct bank. Run grounding electrode system conductors continuously in duct banks, through handholes, other raceway boxes, and cable tray exteriors. Connect conductors to structure ground ring or grounding system to provide a continuous grounding electrode system.

C. Bond electrical enclosures, including metallic raceways, panels, switchboards and other similar metallic panels, cases and devices associated with power, instrumentation, and control systems to the grounding electrode system.

D. Drive ground rods and install grounding conductors prior to construction of concrete slabs and duct banks.

1. Extend grounding conductors through concrete to accessible points for grounding equipment and electrical enclosures.
2. Install grounding system at each structure where switchgear, motor control centers, switchboards, panelboards, panels, or other electrical equipment are installed.

E. Provide either exothermic welded or mechanical connections for grounding cable to rods or cable.

F. When size is not indicated on the Drawings, size grounding conductors in accordance with NEC Table 250-66 and Table 250-122.

G. Provide a green insulated equipment grounding conductor, or multi-conductor cable with integral green insulated grounding conductor, with each feeder and branch circuit from the power source grounding means to the load equipment or device.

H. Provide ground bushings at both ends of rigid conduit runs. Do not use locknuts. Bond ground bushings to the grounding system.

I. When not indicated on the Drawings, provide a minimum size of No. 2/0 or larger grounding electrode systems in compliance with NEC-250.

3.02 FIELD QUALITY CONTROL

A. Test ground resistance, as specified in Section 16950, of entire system and at each building/structure where electrical equipment is installed.

B. Invite ENGINEER to witness ground resistance testing.

C. Where maximum allowable ground resistance of 5 ohms is exceeded, install additional grounding mats or ground rods until ground resistance is equal to or below maximum allowable ground resistance.

END OF SECTION

SECTION 16075 ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Identification of electrical conductors, raceways, disconnect switches, instruments, control panels and process equipment, and electrical equipment signs.

1.02 REFERENCES

A. National Electrical Code (NEC):

1. Article 110-22 - Disconnecting Means.
2. Article 210-4 - Multiwire Branch Circuits.
3. Article 200 - Use and Identification of Grounded Conductors.
4. Article 384 - Switchboards and Panelboards.
5. Article 300 - Wiring Methods.

1.03 SUBMITTALS

A. Shop Drawings:

1. General: Submit shop drawings for electrical equipment room layouts, drawn at a minimum at 3/8 inch = 1 foot, scale.
2. Cross Reference: Diagram shall carry a uniform and coordinated set of wire numbers and terminal block numbers to permit cross-referencing between the contract document drawings, the drawings prepared by the CONTRACTOR, and equipment O&M Manual Drawings.
3. Drawing number cross references and continuation references shall also be provided. Contractor-prepared drawings shall reference applicable Contractor drawings such as P&IDs, control and logic diagrams, interface wiring diagrams, panel drawings, etc. CONTRACTOR-prepared drawings shall be submitted in 11 inch by 17 inch or larger paper size and drawn with AutoCAD software and they shall also reference applicable drawings provided by equipment manufacturers.
4. On any drawing prepared for this project, if a wire, circuit, enclosure, panel, or device is continued on another drawing, the continuation drawing shall be referenced (and vice-versa). Wherever wires are shown connected to terminals, the drawings which show the continuation of the circuits on those terminals must be referenced.
5. Interconnection Diagrams: Cables shall not be installed into raceways until the wiring interconnection diagrams are reviewed by the design engineer.
6. Sample schematics and diagrams are indicated on typical detail drawings for reference and understanding of minimum information required for submittal of shop drawings schematics and diagrams, and submittal of O&M schematics and diagrams.
7. Include tagging system, labels, markers, hazard tape, nameplates, and signs.

B. Product Data: Include tagging system, labels, markers, and hazard tape.

C. Project Record Documents:

1. Document wire, cable, and conductor tags, and bundle tags installed in accordance with the Contract Documents.
2. Document installed wire, cable, and conductor tags and bundle tags when not specifically indicated.
3. Indicate on Record Drawings deviations from accepted shop drawing conductor identification.

1.04 QUALITY ASSURANCE

A. Pre-Installation Conference:

1. Purpose: To clearly define requirements specified for circuit/cable/conductor identification, hold a meeting including representatives of CONTRACTOR, OWNER, and ENGINEER prior to significant cable or conductor purchase and installation/termination.

PART 2 PRODUCTS

2.01 LABELS

A. Manufacturers: One of the following or equal:

1. Brady.
2. Seton.

B. Type: Sleeve type.

2.02 CONDUCTOR AND CABLE MARKERS

A. Wire Markers

1. All conductors including field conductors and internal panel conductors shall be permanently marked with wire numbers at each end.
2. Markers shall consist of machine printed, black characters on white tubing.
   a. General.
      1) Tubing shall be sized for the wire and insulation on which it is to be placed.
      2) Tubing shall be tight on the wire.
      3) Characters shall face the open panel, and shall read from left to right or top to bottom.
      4) Machine printed.
      5) Wire marker shall start within 1/32 inch of end of stripped insulation point.
   b. Heat-shrinkable tubing.
      1) Tubing shall be shrunk using a heat gun which produces low temperature heated air.
      2) Manufactured by:
         a) Raychem.
         b) Brady.

c) Thomas & Betts.
d) Kroy.

c. Pre-printed slip on sleeve markers.
1) Manufactured by:
a) Grafoplast.

B. Markers used in tunnels or other wet locations and for all security system labels shall be on heat-shrinkable marking sleeves.

C. Use self-laminating vinyl on white background for markers within electrical equipment such as panels, termination cabinets, motor control centers.

2.03 RACEWAYS IDENTIFICATION (TAGS)

A. Conduit numbers shall be pressure stamped into a noncorrosive 2 inch long, 1/2 inch wide stainless steel tape, Dymo marking system or equal. A tag with number shall be fixed with No. 18 AWG or larger type 304 stainless steel wire, to each conduit segment and at the end of each conduit and within 3 feet of each pull box, panelboard and switchboard.

2.04 NAMEPLATES, LABELS AND SIGNS

A. Nameplates:

1. Type: Black lamicoid with white letters.
2. Fastener: Round head stainless steel screws.

B. Automatic Equipment and High Voltage Warning Signs:

1. Type: Suitable for exterior use and meeting OSHA regulations.

C. Security System Cable Circuit Raceway Labels: Vinyl plastic.

1. Manufacturers: One of the following or equal:
a. Brady.
b. Seton.

D. Underground Hazard Tape: 6 inches wide.

1. Manufacturers: One of the following or equal:
a. Panduit.
b. Thomas and Betts.

PART 3 EXECUTION

3.01 CIRCUIT IDENTIFICATION

A. Identify 3-phase system conductors and cables as Phases A, B, and C and identify 1-phase system conductors and cables at electrical equipment including, but not limited to, switchgear, switchboards, panelboards, motor control centers, and motors.

1. Match OWNER's existing electrical system identification scheme or meet requirements of the authority responsible for the project.
2. 3-phase 480 Volts AC System Conductors: Phase A, brown; Phase B, orange; Phase C, yellow.
3. Three-Phase Conductors for 120/208 VAC Circuits: Phase A, black; Phase B, red; Phase C, blue.
4. Neutral Conductor: White for 120 VAC and gray for 277 VAC.
5. Insulated Equipment Grounding Conductor: Green.
6. General Purpose AC Control Conductors: Purple.
7. General Purpose DC Control Conductors: Purple with white stripes.
8. Single-Phase Conductors for 120/240 VAC Circuits: Phase A, Black; Phase B, red.

B. Use color coding and phasing consistent throughout the site. Bus bars at panelboards and motor control centers to be connected Phase A-B-C, top to bottom, or left to right facing connecting lugs.

C. Conductors Number 2 American Wire Gauge (AWG) and smaller to be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables to be coded by the use of colored tape.

D. In addition to color coding, for all 1-phase and 3-phase systems, identify each cable (single or multi-conductor) and conductor at each end, in each manhole, pullbox, cable tray, or other component of the raceway system. This identification is applicable to all power, control, alarm, signal, and instrumentation cables, and conductors.

E. Identify each cable (single or multi-conductor) and groups or bundles of individual single conductors in each manhole, pullbox, cable tray or other component of the raceway system with circuit identification markers. Implement a "from-to" cable/conductor bundle tagging system as part of this identification effort. Label cables/conductors in wireways at 30 foot intervals.

F. Identify each individual conductor at each termination. This includes such locations as switchgear, switchboards, motor control centers, variable frequency drives, control panels, junction/terminal boxes, all field devices, security panels and junction boxes, and all other locations where conductors are terminated. Identify the termination of these conductors in accordance with the accepted shop drawings. Tag conductors with sleeve type labels.

G. Where more than 1 nominal voltage system exists, identify each ungrounded system conductor by phase and system. Permanently post means of identification at each branch-circuit panelboard, switchboard, switchgear, motor control center, or other type of power distribution equipment.

H. Include the following minimum information for wire and cable identification:

1. Circuit number or load identification tag number.
2. Origin (from source).
3. Destination (to load).

I. Wire Numbers:

1. The CONTRACTOR shall coordinate the wire numbering system with all vendors of equipment so that each and every field wire has a unique wire number associated with it for the entire system.

a. Wire numbers shall correspond to the wire numbers on the control drawings, or panel and circuit numbers for receptacles and lighting.

b. Wire numbers shall correspond to the terminal block number to which they are attached in the control panel.

c. Internal panel wires on a common terminal shall have the same wire number assigned.

d. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. All individual control conductors and instrumentation cable shall be identified at pull points as described above.

1) Armored multiconductor cable shall be labeled using the conduit number shown on the plans, following the requirements for conduit markers in Section 16075.

2. The following wiring numbering scheme shall be followed throughout the project and used for field wire numbers between PCMs, VCPs, MCCs, field starters, field instruments, etc.

```
(ORIGIN LOC.) - (ORIGIN TERM.) / (DEST. LOC.) -
                (DEST. TERM.)

                    OR

(ORIGIN LOC.) - (ORIGIN TERM.)
 (DEST. LOC.) - (DEST. TERM.)
```

Where:

ORIGIN LOC. = Designation for originating panel or device.
ORIGIN TERM. = Terminal designation at originating panel or device.
DEST. LOC. = Designation for destination panel or device.
DEST. TERM. = Terminal designation at destination panel or device,
OR
DEST. TERM. = PLC I/O address at destination panel.

a. Equipment and field instruments are always identified as the origin.

b. PCMs are always identified as the destination.

c. Location is the panel designation for VCP, LCP or PCM. For connections to MCCs, location is the specific starter tag and loop number. Location is the tag and loop number for motor starters, field instruments and equipment. Any hyphen in the panel designation or tag and loop number shall be omitted.

d. Terminal designation is the actual number on the terminal block where the conductor terminates at field devices and vendor control panels. For multi-conductor cables, all terminal numbers shall be shown, separated by commas.

e. Terminal designations at motor leads shall be the motor manufacturer's standard terminal designation (T1, T2, T3, etc.)

f. Terminal designations at PCMs where the field conductor connects to a PLC input or output shall be the PLC address (Note: the following PLC I/O numbering scheme is typical for Allen Bradley, the numbering scheme should be modified to match that of the actual PLC manufacturer used for the project).

1) W:X:Y/Z for a discrete point or W:X:Y.Z for an analog point.

```
W    =    I for input, O for Output.
X    =    PLC number (1,2,3...).
Y    =    Slot number (01, 02, 03...).
Z    =    Terminal number (00, 01, 02...) for
a discrete point.
Z    =    Word Number (1,2,3...) for an analog
point.
```

2) Examples of discrete points: I:1:01/01, O:2:10/07
3) Examples of analog points: I:1:01.2, O:2:02.3

g. Terminal designations at PCMs where the conductor does not connect to a PLC I/O point shall be the terminal number with a “C” prefix (C0010). For common power after a fuse or neutrals after a switch the subsequent points will have an A, B, C, ... etc. suffix (C0010A).

3. Case 1: Vendor Control Panel (VCP) to Process Control Module (PCM):

Field wire number/label: A-B/C-D

A = Vendor Control Panel number without hyphen (VCP111).
B = Terminal number within VCP, MCC, or starter (manufacturer/vendor’s standard with be acceptable).
C = Process control module without a hyphen (PCM100).
D = Either PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a “C” prefix if not connected directly to a PLC I/O point (C0010).

Examples: VCP111-10/PCM100-I:1:01/01.
VCP111-10/PCM100-O:1:10/07.
VCP111-10/PCM100-C0100.

4. Case 2: Field instrument to PCM:

Field wire number/label: E-F/C-D

C = Process control module without hyphen (PCM100).
D = Either PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a “C” prefix if not connected directly to a PLC I/O point (C0010).
E = Field mounted instrument tag and loop numbers without hyphen (PITA300).
F = Manufacturer’s standard terminal number within instrument. Use both terminal numbers for analog points separated by a comma.

```
Examples: PITA300-2,3/PCM300-I:1:01.1.
          TSHA101-1/PCM200-I:2:01/00.
```

5. Case 3: Motor Control Center (MCC) to PCM:

Field wire number/label: G-B/C-D

B = Terminal number within VCP, MCC, or starter (manufacturer/vendor’s standard will be acceptable).
C = Process control module without hyphen (PCM100).

D = Either PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a “C” prefix if not connected directly to a PLC I/O point (C0010).
G = MCC use actual starter designation in MCC i.e., MSA131 without hyphen located in MCC-120.

Examples: MSA131-10/PCM100-I:1:01/01.
MSA131-10/PCM100-O:1:10/07.
MSA131-10/PCM100-C0100.

6. Case 4: MCC to VCP:

Field wire number/label: G-B/A-B
A = Vendor Control Panel number without hyphen (VCP111).
B = Terminal number within VCP, MCC, or starter (manufacturer/vendor’s standard with be acceptable).
G = MCC use actual starter designation in MCC i.e., MSA131 without hyphen located in MCC-120.

Example: MSA131-X2/VCP111-10.

7. Case 5: Motor leads to MCC

Field wire number/label: H-I/G-B
B = Terminal number within VCP, MCC, or starter (manufacturer/vendor’s standard with be acceptable).
G = MCC use actual starter designation in MCC i.e., MSA131 without hyphen located in MCC-120.
H = Equipment tag and loop number without hyphen (RWP131).
I = Motor manufacturer’s standard motor lead identification (T1, T2, T3, etc.)

Example: RWP131-T1/MSA131-T1.

8. Case 6: Remote or separately mounted starters or VFDs to PCM

Field wire number/label: J-B/C-D
B = Terminal number within VCP, MCC, or starter (manufacturer/vendor’s standard will be acceptable).
C = Process control module without hyphen (PCM100).
D = Either PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a “C” prefix if not connected directly to a PLC I/O point (C0010).
J = Remote mounted starter or VFD tag and loop number without hyphen (MSA121)

Examples: MSA121-10/PCM100-I:1:01/01.
MSA121-10/PCM100-O:2:10/07.
MSA121-10/PCM100-C0010.

9. All spare conductors shall be terminated on terminal blocks and shall be identified as required for other field wires, with an “S” prefix.

Example: S MSA315-21/PCM200-C0125

3.02 NAMEPLATES

A. Furnish and install nameplates for all electrical equipment indicated on the Drawings or specified. Also, use single line and panel schedule legends for nameplate data.

B. Each disconnect means for service, feeder, branch, or equipment conductors and pushbutton stations shall have nameplates indicating its purpose or identifying the load.

3.03 AUTOMATIC EQUIPMENT WARNING SIGNS

A. Mount permanent warning signs at mechanical equipment which may be started automatically or from remote locations. Fasten warning signs with round head stainless steel screws or bolts, located and mounted in a manner acceptable to ENGINEER.

B. Mount permanent and conspicuous warning signs on (front and back) equipment, doorways to equipment rooms, pull boxes, manholes, where the voltage exceeds 600 volts.

C. Place a warning ribbon or other effective means suitable for conditions above ductbank underground installations.

D. Place warning signs on utilization equipment that has more than one source of power. Provide panel and circuit number of conductor tag of the power source disconnect.

E. Place warning signs on utilization equipment that has 120 VAC control voltage source used for interlocking. Provide panel, circuit number, and conductor tag of control voltage source disconnect.

END OF SECTION

SECTION 16122 MOTORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Single phase motors, direct current motors, and 3-phase motors up to and including 50 horsepower.

B. Related Sections:

1. Review the specifications of water pumps and process equipment for additional requirements of motorized equipment.

1.02 REFERENCES

A. American Bearing Manufacturers Association (ABMA):

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Institute of Electrical and Electronic Engineers (IEEE).

1. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
2. IEEE 841 - Recommended Practice For Chemical Industry Severe Duty Squirrel Cage Induction Motors.
3. IEEE 43 - Recommended Practice For Testing Insulation Resistance of Rotating Machinery.

C. National Electrical Manufacturers' Association (NEMA):

1. MG-1 - Motors and Generators.
2. NEMA MG-2 - Safety Standards for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators.

1.03 DEFINITIONS

A. Solid-State Motor Controller: Includes variable frequency drives and solid-state reduced voltage starters.

B. Nominal Efficiency: The average full load efficiency value of a large population of the manufacturer's motors of the same design.

C. Minimum Efficiency: The minimum full load efficiency value of any individual motor associated with the nominal motor efficiency.

1.04 SUBMITTALS

A. Product Data:

1. Descriptive bulletins.
2. Outline drawings with dimensions.
3. Cut-away and exploded view drawings.
4. Parts list with material designations.
5. Nameplate data.
6. Motor weight, frame size and conduit box location.
7. Description of insulation system.

B. Design and Performance Data:

1. Bearing design and bearing life calculations.
2. Performance Data Required by Schedule A, Nameplate Data, and Following Information:
   a. Service factor.
   b. Efficiency at 1/2 and 3/4 load.
   c. Power factor at 1/2 and 3/4 load.
3. Special features including condensation heaters and winding temperature detectors.
4. Performance data for motors with synchronous speed of 900 revolutions per minute and below.
5. Factory test reports with test reference standard identified.
6. Condensation heaters and winding temperature detectors.
7. Factory test reports with test reference standard identified.

1.05 QUALITY ASSURANCE

A. Certification:

1. When motors are driven by variable speed drive systems, submit certification that selected motor:
   a. Is capable of satisfactory performance under the intended load.
   b. Is suitable for operation with the proposed variable speed drive unit.

1.06 PROJECT/SITE CONDITIONS

A. Provide motors designed to produce their nameplate horsepower, service factor, Speed (RPM) and suitable enclosure for the project altitude, temperature, humidity and process environment.

1.07 WARRANTY

A. Provide smaller than 50 horsepower with warranty for a period of one year from the date of substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Motors: One of the following or equal:

1. U. S. Motors.
2. General Electric.
3. Baldor.
4. Toshiba.

2.02 ELECTRICAL MOTORS

A. General:

1. Manufactured with cast iron frames in accordance with NEMA MG 1, and in accordance with specified requirements.
2. Alternating Current Motors: Squirrel cage induction type suitable for 60 hertz power.
3. Where not otherwise specified or indicated on the Drawings:
   a. Motors 1 Horsepower and Larger: 3-phase, 460 volt.
   b. Motors less than 1 Horsepower: Single phase, 120 volt.
4. 2-Speed Motors: Dual winding design.
5. Temperature Rating and Altitude Requirements: Where not otherwise specified or indicated on the Drawings, provide motors that are rated suitable for continuous operation in 40 degrees Celsius ambient temperature at project site altitude.
   a. Temperature Rise under Full Load: Not to exceed that for Class B insulation (80 degrees Celsius).
6. Motor Data: Specific motor data including horsepower, speed, and enclosure type are indicated on the Drawings and specified under equipment for which motor is required.
7. Torque and Power of Motors:
   a. Provide motors that develop sufficient torque for required service throughout acceleration range at voltage 10 percent less than motor nameplate rating.
   b. Provide motors that develop sufficient torque when started using reduced voltage starters.
8. Motor Leads and Insulating Material: Insulated leads with non-wicking, non-hydroscopic material. Class F insulation.
9. Grounding Lugs: Provide inside conduit boxes for motor frame grounding.
10. Hardware: Type 316 stainless steel.

B. Provide motors that are special premium efficiency type, except motors that are to be used on hoisting equipment, heat pumps, unit heaters, sump pumps, and lubricating oil transfer pumps.

1. Provide premium efficiency type motors having nominal full load efficiencies and power factors as specified in Schedule A appended to this Section.
2. Actual full load efficiency of individual motors within the nominal efficiency band shall not be less than the minimum efficiency value specified in Schedule A.

C. Condensation Heaters:

1. Use: Required in motors in outdoor applications.
2. Type: Cartridge or flexible wrap-around type installed within motor enclosure adjacent to core iron.
3. Rating, Phase and Wattage: Rated for 120 volt, single phase with wattage as required.
4. Bring power leads for heaters into conduit box.

D. Winding Temperature Detectors:

1. When specified for individual equipment and on alternating current motors connected to a solid-state motor controller, provide factory installed winding temperature detector with leads terminating in conduit box.
2. Provide detectors that protect motor against damage from overheating caused by single phasing, overload, high ambient temperature, abnormal voltage, locked rotor, frequent starts, or ventilation failure.
   a. For Motors Less than 200 Horsepower: Provide detector that has normally closed contacts.
3. Auxiliary Relays and Controls: Provide relays and controls and mount them in controller enclosure which is suitable for the environment.
4. Provide auxiliary low voltage interface module with intrinsically safe circuit for motors located in Hazardous Classified Areas.

E. Internal Cooling Motors: Design motors having speeds of 900 revolutions per minute and less, and motors that are connected to solid-state motor controllers with special attention to internal cooling.

F. Provide oversize terminal boxes for termination of shielded cables.

2.03 SINGLE PHASE MOTORS

A. Capacitor start type rated for operation at 115 volts, 60 hertz, unless otherwise specified or indicated on the Drawings.

B. Totally enclosed, fan cooled motors manufactured in accordance with NEMA MG 1-10.35.

C. Ball Bearings: Sealed.

D. 1/2 Horsepower or Less Fan Motors:

1. Split-phase or shaded pole type when standard for the equipment.
2. Open type when suitably protected from moisture, dripping water, and lint accumulation.

E. Wound rotor or commutator type single phase motors only when their specific characteristics are necessary for application and their use is acceptable to the ENGINEER.

2.04 DIRECT CURRENT MOTORS

A. Designed to operate from direct current.

B. Sealed ball bearings having ABMA B-10 life of 60,000 hours or more.

C. Insulation System: NEMA 1-1.65, Class F, resistant to attack by moisture, acids, alkalies, and mechanical or thermal shock.

D. Totally enclosed fan cooled enclosures.

2.05 3-PHASE MOTORS

A. Suitable for 460 volt 3-phase power unless otherwise specified or indicated on the Drawings.

B. NEMA Design B except where driven load characteristics require other than normal starting torque.

1. Starting kilovolt ampere per horsepower (locked rotor) are not to exceed values specified in NEMA MG-1-10.37.
2. Motors for use with variable frequency drives shall be inverter duty rated and meet requirement of IEEE 841.
3. All motors greater or equal to 1 horsepower shall meet the requirements of IEEE 841.

C. Motor Bearings: Antifriction, regreasable, and filled initially with grease suitable for ambient temperatures to 40 degrees Celsius.

1. Suitable for intended application and have ABMA B-10 rating life of 60,000 hours or more.
2. Fit bearings with easily accessible grease supply, flush, drain, and relief fittings using extension tubes where necessary.
3. Provide two pole motors with sleeve type bearings.
4. Provide special trust bearings on vertical motors of suitable applications and reliable for long term life rating not less than 100,000 hours.

D. Insulation Systems:

1. Comply with NEMA 1-1.65.
2. Class F system with Class B temperature rise.
3. Resistant to attack by moisture, acids, alkalies, and mechanical or thermal shock.
4. Winding Coils for motors 150 horsepower and smaller shall be of 100 percent copper material and the coils may be random wound.
5. Winding Coils for motors larger than 150 horsepower shall be of 100 percent copper material and they shall be form wound. The coils insulation shall have a heavy duty glass film to prevent coil turn to turn short circuit, and resist stress for severe duty.

E. Conduit Boxes: Cast iron or stamped steel, split from top to bottom and capable of being rotated to 4 positions.

1. Provide gaskets between following:
   a. Frames and conduit boxes.
   b. Conduit boxes and box covers.

2. Provide separate motor conduit boxes for power leads and instrumentation and control cable leads on all VFD-supplied motors and on motors over 50 hp.

F. Motor Enclosures: Provide one of the following types:

1. Open Drip Proof: Stamped steel conduit boxes; 1.15 service factor at 40 degrees Celsius only for application indoor, non-humid and dry locations.
2. Totally Enclosed Fan Cooled (TEFC): Cast iron conduit box; 1.15 service factor at 40 degrees Celsius ambient; tapped drain holes with Type 316 stainless steel plugs for frames 286T and smaller, and automatic breather and drain devices for frames 324T and larger; upgraded insulation by minimum of 3 dips and bakes and sealer coat of epoxy or silicone. The TEFC enclosure shall be provided for all motors in wet and humid locations, outdoor locations, and indoor locations where the application requires periodic water hose cleaning.
3. Explosion-proof: 1.15 service factor at 40 degrees Celsius; tapped drain holes with corrosion resistant plugs for frames 286T and smaller and automatic breather and drain devices for frames 324T and larger; UL label for Class I, Division 1, Group D hazardous area.
4. Severe Duty: Corrosion resistant type conforming to motors designated by manufacturer as "Chemical Duty," "Mill and Chemical," "Custom Severe Duty," or similar applicable manufacturer's quality designation with 1.15 service factor at 40 degrees Celsius; tapped drain holes with Type 316 stainless steel plugs for frames 286T and smaller and automatic breather and drain devices for frames 324T and larger; epoxy finish; and upgraded insulation using encapsulated or dip and bake windings.
5. All motors installed indoors and in wet areas shall have TEFC enclosures.
6. All motors installed outdoors shall have TEFC enclosures and suitable for severe and corrosion resistant duty, unless otherwise the application specifications explosion proof enclosure.
7. All motors with application speed of 1200 RPM and lower and driven by VFDs shall have special provisions for proper cooling. Verify motor cooling provisions suitable for minimum application speed.

2.06 MOTOR SIZES

A. Motor sizes specified in the Specifications and indicated on the Drawings are minimum sizes.

B. Provide motors, electrical circuits, and equipment of ample horsepower capacity to operate equipment without exceeding rated nameplate horsepower, full-load current at rated nameplate voltage, or overheating at maximum load capacity.

2.07 SOURCE QUALITY CONTROL

A. Factory Testing of 3-Phase Motors:

1. When specified in individual equipment specifications, factory test motors. Include testing of:
   a. No load current.
   b. Locked rotor current.
   c. Winding resistance.
   d. High potential.

2. Perform in accordance with applicable NEMA Standards.
3. Furnish copies of test reports.

B. Efficiency Testing: Factory test in accordance with IEEE 112, using method A or B of Section 5, as appropriate for motor rating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install motors in accordance with manufacturer's instructions.

3.02 SCHEDULES

A. Schedule A: Full load motor efficiency and power factor rating requirements for premium efficiency, 460 volt, 3-phase horizontal motors.

SCHEDULE A

FULL LOAD MOTOR EFFICIENCY AND POWER FACTOR RATING REQUIREMENTS FOR PREMIUM EFFICIENCY, 460 VOLT, 3 PHASE HORIZONTAL AND VERTICAL MOTORS

		Protected (Open Drip Proof)[1]			Totally Enclosed Fan Cooled[1]		
Nominal Horsepower (Horsepower)	Syn. (revolutions per minute)	Minimum Efficiency (Percent)	Nominal Efficiency (Percent)	Power Factor (Percent)	Minimum Efficiency (Percent)	Nominal Efficiency (Percent)	Power Factor (Percent)
1	1,800	81.5	84.0	70.9	81.5	84.0	77.7
	1,200	78.5	81.5	57.0	78.5	81.5	57.0
1-1/2	3,600	81.5	84.0	86.0	81.5	84.0	86.0
	1,800	81.5	84.0	73.0	81.5	84.0	77.4
	1,200	81.5	84.0	67.8	84.0	86.5	67.8
2	3,600	81.5	84.0	87.7	84.0	86.5	87.7
	1,800	81.5	84.0	76.7	81.5	84.0	78.8
	1,200	84.0	86.5	68.1	85.5	87.5	68.1

SCHEDULE A

FULL LOAD MOTOR EFFICIENCY AND POWER FACTOR RATING REQUIREMENTS FOR PREMIUM EFFICIENCY, 460 VOLT, 3 PHASE HORIZONTAL AND VERTICAL MOTORS

		Protected (Open Drip Proof)[1]			Totally Enclosed Fan Cooled[1]		
Nominal Horsepower (Horsepower)	Syn. (revolutions per minute)	Minimum Efficiency (Percent)	Nominal Efficiency (Percent)	Power Factor (Percent)	Minimum Efficiency (Percent)	Nominal Efficiency (Percent)	Power Factor (Percent)
3	3,600	80.0	82.5	90.4	84.0	86.5	82.8
	1,800	86.5	88.5	78.9	86.5	88.5	79.2
	1,200	87.5	89.5	71.0	87.5	89.5	71.0
5	3,600	86.5	81.5	84.5	86.5	88.5	87.0
	1,800	87.5	88.5	80.4	86.5	88.5	81.0
	1,200	88.5	89.5	73.0	87.5	89.5	74.4
	900	87.5	87.5	70.0	87.5	89.5	70.5
7-1/2	3,600	86.5	88.5	86.7	87.5	89.5	86.3
	1,800	87.5	89.5	83.3	88.5	90.2	84.4
	1,200	88.5	90.2	78.2	88.5	90.2	78.3
	900	87.5	89.5	72.0	87.5	89.5	72.0
10	3,600	88.5	90.2	85.5	89.5	91.0	87.5
	1,800	88.5	90.2	82.8	88.5	90.2	86.0
	1,200	89.5	91.0	80.5	89.5	91.0	81.0
	900	89.5	91.0	75.8	88.5	90.2	76.0
	900	96.3	96.4	77	95	95.2	71

Notes:

(1) Motor data for continuous duty, NEMA Design B, 1.15 service factor, 40 degrees Celsius ambient, Class F insulation, 3 phase, 460 volt, at listed speed rating.
(2) Correct to 95 percent power factor and submit capacitor size in KVAR as specified in Article titled "Submittals."
(3) Totally enclosed fan cooled efficiencies apply to both horizontal and vertical motors.

END OF SECTION

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SECTION 16123 600 VOLT OR LESS WIRES AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. 600 volt class wire and cable.
2. Instrumentation class wire and cable.
3. Communication and Security System wire and cable.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. B 3 - Standard Specification for Soft or Annealed Copper Wire.
2. B 8 - Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

B. Insulated Cable Engineers Association (ICEA).

C. National Electrical Code (NEC):

1. Article 250 - Grounding.
2. Article 310 - Conductors for General Wiring.
3. Article 725 - Class 1, Class 2, and Class 3 Remote - Control, Signaling, and Power-Limited Circuits.
4. Article 760 - Fire Alarm Systems.
5. Article 800 - Communication Circuits.

D. Underwriters' Laboratories, Inc., (UL):

1. UL 1277 Subject - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.03 SUBMITTALS

A. Shop Drawings: Show splice locations. Submit cable pulling calculations for all cable feeder larger than 2/0 AWG and pulling lengths longer than 200 feet. Submit cable pulling calculations for all conductor runs longer than 400 feet.

B. Product Data: Include wires, cables, pulling compounds, and splicing materials.

1.04 QUALITY ASSURANCE

A. Conform to ASTM and ICEA standards.

B. Furnish mechanical conductor connector and heat-shrink type insulation by same manufacturer.

PART 2 PRODUCTS

2.01 WIRE AND CABLE MATERIALS

A. Conductors: ASTM B 8, soft drawn copper, maximum 12 months old, minimum 97 percent conductivity. American Wire Gauge (AWG) sizes as indicated on the Drawings, Class B or C stranded.

B. Insulation Thickness: Minimum specified by NEC Article 310.

C. Conductor Sizes: As indicated on wiring schedules and Drawings.

2.02 600-VOLT CLASS CABLE

A. Power Wire and Cable:

1. Manufacturers: One of the following or equal:
   a. Okonite Company.
   b. General Cable.
   c. Rockbestos Company.
   d. Southwire Company

B. Shielded Power Cable:

1. Manufacturers: One of the following or equal:
   a. Olflex.

C. Control Wire and Cable:

1. Manufacturers: One of the following or equal:
   a. Okonite Company.
   b. General Cable.
   c. Rockbestos Company.
   d. Southwire Company

D. Insulation for Individual Wires or Multiple Conductor Cable for Power and Control Circuits:

1. Type XHHW-2 insulation for use in dry and wet locations and underground ductbanks.

E. Jackets for Multiple Conductor Cable for Power and Control Circuits: Type CPE.

F. Tray Cable:

1. Minimum size Number 1/0 AWG for single wires.
2. Multi-conductor cable listed and identified on its surface as suitable for cable tray use, Type TC cable in accordance with NEC Article 318.

3. Multi-Conductor Cables Requiring Connection to Neutral: Provided with integral white insulated conductor with ambient temperature adjustment in accordance with NEC Table 310-16.

G. Multi-Conductor Cable Insulated Grounding Conductors:

1. Color: Integral green.
2. Sizes: In accordance with NEC 250-122.

H. Solid-conductor wire, Number 12 AWG and smaller, may be used only for lighting and receptacle circuits.

2.03 INSTRUMENTATION CLASS CABLE

A. Single Pair or Triad Applications:

1. Manufacturers: One of the following or equal:
   a. The Okonite Company, Okoseal-N Type P-OS.
   b. Equivalent manufactured by Cooper Industries, Belden Wire and Cable Division.

B. Multiple Pair or Triad Applications:

1. Manufacturers: One of the following or equal:
   a. The Okonite Company, Okoseal-N Type SP-OS.
   b. Equivalent manufactured by Cooper Industries, Belden Wire and Cable Division.

C. Approved for cable tray installation in accordance with the National Electrical Code.

D. Number of Individually Shielded, Twisted Pairs and Triads: As indicated on the Drawings or as necessary for the application.

E. Voltage Rating: 600 volts.

F. Cable Type: TC.

G. Temperature Rating: 90 degrees Celsius dry location, 75 degrees Celsius wet location.

H. Conductors: Bare, soft annealed copper in accordance with ASTM B 3, Class B, 7-strand concentric in accordance with ASTM B 8.

I. Conductor Insulation: Flame-retardant polyvinyl chloride, 15 mils nominal thickness, with nylon jacket 4 mils nominal thickness, 90 degrees Celsius temperature rating in accordance with Underwriter's Laboratory Subject 1277.

J. Color Code: Provide conductor color code as specified in Section 16075.

K. Single Pair or Triad Shielding:

1. Group Shielding: Minimum 1.35 mil double-faced aluminum/synthetic polymer-backed tape overlapped to provide 100 percent coverage.

2. Drain Wire: 7-strand tinned copper drain wire, 2 sizes smaller than conductor.

L. Multiple Pair or Triad Shielding:
1. Group Shield: 1.35 mil aluminum-polyester tape overlapped to provide 100 percent coverage and a 7-strand tinned copper drain wire, 2 sizes smaller than conductor. Completely isolate group shields from each other.
2. Cable Shield: 2.35 mils double-faced aluminum and synthetic polymer backed tape overlapped to provide 100 percent coverage and a 7-strand tinned copper drain wire, same size as conductors.

M. Jacket: Black, flame-retardant in accordance with Underwriters' Laboratory Subject 1277, 90 degrees Celsius temperature rating, rip cord laid longitudinally under jacket to facilitate removal.

N. Conductor Size: Number 16 AWG minimum unless otherwise indicated on the Drawings.

O. Numerically identify one conductor within each pair and triad.

2.04 COMMUNICATION CABLE

A. Manufacturers: One of the following or equal:

1. Cooper Industries, Belden Wire and Cable Division.
2. American Telephone and Telegraph.

B. Number of Twisted Pairs: As indicated on the Drawings.

C. Voltage Rating: 300 volts.

D. Insulation: Thermoplastic, color coded in accordance with telephone industry standards.

E. Jacket: High molecular weight polyethylene, surface printed with year of manufacture and cable description at maximum 24 inch intervals.

F. Shield: 8 mil aluminum or copper, overlapped to provide 100 percent coverage, covered totally on both sides with copolymer or equal coating able to provide an effective moisture barrier.

G. Inner Jacket: High molecular weight polyethylene, able to provide strength and surge barrier.

H. Conductors: ASTM B3, solid, soft, bare copper.

I. Conductor Size: Minimum Number 22 AWG , unless otherwise indicated on the Drawings.

J. Fabrication:

1. Twist insulated conductors into pairs with varying lengths of lay.
2. Apply non-hygroscopic core tape over cable core as a dielectric and heat barrier.

2.05 RELATED MATERIALS

A. Splicing Material:

1. In conformance with ANSI C119.1, IEEE 383, and ICEA 5-19-81.
2. Manufacturers: One of the following or equal:
   a. Elastimold.
   b. Thomas-Betts.
   c. Raychem, FCSM Series.

B. Wire Nuts:

1. Rated 600 volt with live-spring feature for tight fitting connections.
2. Manufacturers: One of the following or equal:
   a. 3M.
   b. Thomas and Betts.

C. Junction Boxes and Terminal Cabinets: As specified in Section 16134.

D. Pulling Compound: As recommended by conductor manufacturer.

2.06 WIRE AND CABLE FABRICATION

A. Permanently mark American Wire Gauge (AWG) size, grade of insulation, voltage, and manufacturer's name on outer covering at maximum 24 inch intervals.

B. Identify and mark conductors in accordance with NEC Article 310.

C. Color code wire and cable as specified in Section 16075.

1. Integrally color insulation for Number 2 AWG and smaller.
2. Wrap colored tape around cable larger than Number 2 AWG.

D. Fabricate cable ends with provisions for field testing.

2.07 SOURCE QUALITY CONTROL

A. Test full lengths in accordance with ASTM and ICEA Standards.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with Supplier of sludge thickening equipment and provide pertinent wiring including power, instrumentation and control in accordance with equipment shop drawings. Also, provide communication wiring and interconnection between sludge thickener control panel and existing SCADA panel SP-3

B. Coordinate with Supplier of polymer equipment and provide pertinent wiring including power, instrumentation and control in accordance with equipment shop drawings, for interconnection with sludge thickener control panel.

C. Install continuous circuit conductors from source to load without splices or terminations in intermediate manholes or pull boxes, except for Number 10 AWG and smaller conductors for lighting and receptacles.

D. Splices:

1. Where splices are necessary because of extremely long wire or cable lengths that exceed standard manufactured lengths, install and label junction boxes for power conductors or termination cabinets for control and instrument conductors.
2. Power and control conductors routed in common raceways may be spliced in common junction boxes.
3. Install NEMA 4X junction and terminal boxes in wet and outdoor locations. Clearly label junction and terminal boxes containing splices with the word "SPLICE."
4. Leave sufficient slack at junction boxes and termination boxes to make proper splices and connections. Do not pull splices into conduits.
5. Splices in below grade pull boxes or in any box subject to flooding shall be made watertight using:
    a. A heat shrink insulating system listed for submersible applications.
    b. Or an epoxy resin splicing kit.

E. Properly coat wires and cables with pulling compound before pulling into conduits and prevent mechanical damage to conductors during installation.

3.02 600-VOLT CLASS CABLE

A. Size power conductors in accordance with National Electrical Code when sizes are not indicated on the Drawings.

B. Install minimum Number 12 AWG wiring for power circuits unless otherwise specified or indicated on the Drawings, and minimum Number 14 AWG for control wiring unless otherwise specified.

C. Install minimum 14 AWG for internal panel control wiring with type MTW or SIS insulation.

D. Do not exceed cable manufacturer's pulling tension and side-wall pressures.

E. Terminations and Splices (600 Volt or Less):

1. Terminations: Terminate control and instrument conductors in terminal boxes in accordance with Section 16134.
2. Splicing: Join conductors mechanically with splice connectors and install heat-shrink type insulation. Splice conductors in accordance with manufacturer's instructions. Make waterproof heat shrink type splices in wet and below grade locations.
3. Splice or weld grounding conductors of different sizes.
4. Conductor Number 10 AWG and smaller for lighting and receptacle circuits may be spliced in junction boxes with wire nuts.

F. All conductors for installation in underground duct banks, in sizes No. 10 AWG and smaller shall be of the multi-conductor type with overall jacket.

G. All conductors of size No. 1/0 AWG and smaller for installation in cable trays and continuing without splices via other conduits; they shall be of the multi-conductor type with overall jacket.

3.03 INSTRUMENTATION CLASS CABLE

A. Install instrumentation class cables in separate raceway systems.

1. Install instrument cable in metallic conduit within non-dedicated manholes or pull boxes.
2. Install cable without splices between instruments or between field devices and instrument enclosures or panels.

B. Do not make intermediate terminations, except in designated terminal boxes indicated on the Drawings.

C. Ground cable shields at only one location, typically at panels, not at field instruments.

3.04 COMMUNICATION AND SECURITY SYSTEM CABLE

A. Install communication cables in dedicated raceways, including through ductbanks, manholes, and pull boxes.

B. For wire/cable runs in the Operations Building above suspended ceilings, clamp cable to underside of deck or use wire hangers. Do not allow any cable or wire to lie on top of the ceiling panels. Install wire hangers at 4-foot intervals for every wire run. Run wires at least 1 foot above the ceiling where possible. Run wires above other crossing items where possible. In no case shall wiring or cabling rest on the ceiling tiles unless specifically approved by the ENGINEER in writing.

C. After installation, visually inspect all wiring for flaws such as cuts, punctures, and abrasions. If any flaws are found, replace the wire at no additional cost to the OWNER.

D. Run wires continuously from termination to termination without splices. ASSUME NO SPLICES. Splices at certain junction box locations may be allowed at the discretion of the ENGINEER. Make recommendations for splices at such points to ENGINEER and obtain written approval to proceed.

E. Make all connections at terminal boards with full tagging, labeling, and documentation.

F. Tag each cable with a written tag at each end. The designation for the tag shall be the point number of the field point plus letters indicating the cable in the group. For example, tagging for an AA detail would be as follows.

Card Reader	##### - CR
Request to Exit	##### - REX
Door Switch	##### - DSM
Lockset	##### - EL

In each case, "#####" stands for the individual security system point number assigned to the specific location.

G. At no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal, and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and secure to panels.

3.05 SIGNAL CABLE AND CONDUIT INSTALLATION

A. Separate and isolate electrical signal cables from sources of electrical noise and power cables by minimum 12 inches.

B. Install signal cables in dedicated raceways, including through underground vaults and pull boxes.

3.06 FIELD QUALITY CONTROL

A. Testing: As specified in Section 16950.

B. Grounding

3.07 FIELD CONDITIONS AND RELATED REQUIREMENTS

A. Existing underground water table is near or above the location for new ductbanks.

B. Existing underground pull boxes, handholes, ductbanks, and manholes contain excessive amounts of water, conductors and debris.

C. CONTRACTOR shall include cost for necessary dewatering, equipment cost to identify raceways, and cleaning equipment to perform the work required for new underground ductbanks, manholes and pull boxes.

D. CONTRACTOR shall include necessary cost to clean all underground ductbanks and pull boxes prior to installation of required new conductors.

3.08 WIRING SUPPLEMENTAL REQUIREMENTS

A. CONTRACTOR shall include necessary conductors and termination to provide any and all motorized equipment, electrical outlets, fixtures, communication outlets, instruments, and devices within 10 linear feet of location shown on the Drawings.

B. CONTRACTOR shall include necessary conductors and related materials to provide any and all pull boxes, manholes and ductbanks within 20 linear feet of location shown on the Drawings.

C. Prior installation of any raceway or related items identified in paragraphs A and B above, the OWNER shall have the right to make changes related to preferred location, at no additional cost.

D. CONTRACTOR shall provide necessary conductors for all equipment specified, identified in wiring/raceway schedules, equipment schedules, panelboards schedules, electrical single line diagrams, block diagrams, process and instrumentation diagrams (P&IDs), fixture schedules, and devices. Said necessary conductors may not be shown on the plan drawings, but they shall be sized by CONTRACTOR in accordance with requirements of

the National Electrical Code, and included in this allowance if the conductor are necessary for the complete operation of the included device or equipment.

E. Include cost for supplemental wiring to provide the following wiring for potential extra items not included in the Drawings:
   1. Two thousand (2,000) linear feet of No. 12 AWG-XHHW-2 copper single conductor for installation in conduit.
   2. Two thousand (2,000) linear feet of No. 14 AWG-XHHW-2 for installation in conduit.
   3. One thousand (1,000) linear feet of No. 16 AWG shielded one pair cable for installation in conduit.

END OF SECTION

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SECTION 16133 CONDUITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Galvanized rigid steel conduit.
2. Aluminum Conduit
3. Flexible conduit.
4. Polyvinyl chloride-coated rigid steel conduit, and rigid nonmetallic polyvinyl chloride conduit.

1.02 REFERENCES

A. American National Standards Institute (ANSI):

1. C80.1 - Rigid Steel Conduit, Zinc Coated.

B. Electrical Manufacturers Association (NEMA):

1. RN-1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

C. National Electrical Code (NEC):

1. Article 348 - Electrical Metallic Tubing.
2. Table 300-5 - Minimum Cover Requirements (0 to 600 volts, Nominal).
3. Article 500 - Hazardous (Classified) Locations.
4. Table 10-4(b) - Minimum Cover Requirements (over 600 volts, Nominal).

D. Underwriters' Laboratories, Inc (UL):

1. UL 6 - Rigid Metal Conduit.

1.03 SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Submit shop drawings for installation of conduits in duct banks per additional requirements specified in section 16155.
2. Installation drawing shall include individual conduit numbers, routing, conduit sizes, circuit numbers contained in each conduit, and number and size of wires in each conduit.

PART 2 PRODUCTS

2.01 CONDUIT

A. Galvanized Rigid Steel Conduit:

1. Domestic raw steel, made smooth, clean, and free of burrs and rough spots to enhance wire pulling; interior and exterior surfaces coated with solid, unbroken layer of zinc; threads hot dip galvanized after cutting; entire surface finish coated with secondary bichromate treatment applied over galvanizing able to extend surface protection and prevent oxidation; threads protected by color coded end caps to provide quick trade size identification.
2. Manufacturers: One of the following or equal:
   a. LTV Steel Tubular Products Company, Galvite.
   b. Triangle PWC, Inc.
   c. Allied Tube and Conduit Corporation.

B. Liquid-tight Flexible Conduit: Grounding type, weatherproof, watertight, maximum 60-inch lengths.

1. Manufacturers: One of the following or equal:
   a. American Brass Company.
   b. General Electric.

C. Flexible Metal Conduit: Aluminum with minimum trade size of 1/2-inch, maximum length allowed 60 inches.

1. Manufacturers: One of the following or equal:
   a. ALFLEX.
   b. Allied Tube and Conduit Corporation.

D. Polyvinyl Chloride-coated Rigid Steel Conduit:

1. Galvanized rigid steel conduit with coating conforming to ANSI C80.1 and UL 6; bendable without damage to coatings.
2. Manufacturers: One of the following or equal:
   a. Perma Kote by Robroy Industries.
   b. OCAL, Inc.

E. Rigid Nonmetallic Polyvinyl Chloride Conduit:

1. High density, Schedule 40, 90 degrees Celsius, heavy-duty polyvinyl chloride, made from virgin polyvinyl chloride compound; maximum 6 grams per 100 grams smoke emission.
2. Manufacturers: One of the following or equal:
   a. Carlon.
   b. Triangle Conduit and Cable.

2.02 RELATED MATERIALS

A. Couplings, Connectors, and Fittings:

1. Threaded.
2. Manufactured with same materials and process as corresponding conduit.

B. Condulet Fittings:

1. With wedge nut covers, weathertight when located outdoors or in wet or corrosive locations indicated on the Drawings, matching type for corresponding conduit systems.
2. Manufacturers: One of the following or equal:
   a. Crouse-Hinds.
   b. Appleton.

C. Galvanized Rigid Steel Conduit Expansion Fittings for Exposed Locations:

1. Manufacturers: One of the following or equal:
   a. OZ/Gedney, Type AX with jumper.
   b. Appleton, Type XJ with Jumper.

D. Galvanized Rigid Steel Conduit Expansion Fittings at Structural Expansion Joints:

1. Manufacturers: One of the following or equal:
   a. Spring City, Type D.
   b. Crouse-Hinds, Type D.

E. Conduit Seals:

1. Manufacturers: One of the following or equal:
   a. Appleton.
   b. Crouse-Hinds.

F. Polyvinyl Chloride-coated Rigid Steel and Aluminum Conduit Couplings: One provided loose with each length of conduit.

G. Fasteners for Polyvinyl Chloride-Coated Rigid Steel Conduit: Polyvinyl chloride-coated steel fasteners with Type 316 stainless steel bolts, nuts, and hardware.

H. Fasteners for Galvanized Rigid Steel Conduit: Galvanized steel fasteners with Type 316 stainless steel bolts, nuts, and hardware.

I. Conduit Mounting Strut:

1. Type 316 stainless steel for mounting of polyvinyl chloride-coated rigid steel conduit.
2. Hot-dip galvanized for other conduit types.

J. Conduit Thruwall Seals:

1. Hot-dip galvanize.
2. Polyvinyl chloride oversize sleeve.
3. Manufacturers: One of the following or equal:
   a. O-Z/Gedney, Type "WSK."

K. Chemical Containment Area Sealing:

1. To seal conduits from the passage of liquid chemicals, a polyurethane elastomeric caulking material shall be provided at the locations as noted on the Drawings and installed in accordance with the manufacturer's instructions. The material shall be SikaFlex-2C used with primer No. 449 or No. 260 as appropriate for the conduit.

L. Firestopping:

1. Manufacturer:3M Company or Equal.
2. Provide fire barriers sealants, designed to resist high temperature, and to prevent fire, smoke, toxic fumes and moisture from passing through conduit penetrations in fire rated walls and floors.

2.03 POLYVINYL CHLORIDE-COATED RIGID STEEL CONDUIT FABRICATION

A. Coat rigid steel conduit, conduit fittings, and hangers with polyvinyl chloride.

B. Conduit:

1. Ensure that surfaces, including galvanizing, remain intact and undisturbed on both inside and outside of conduit throughout preparation and application processing.
2. Bond polyvinyl chloride coating to outer surfaces of conduit except threads.
3. Provide bond between polyvinyl chloride coating and conduit surface that is greater than tensile strength of plastic.
4. Provide minimum 40 mil thick coating on conduit.
5. Coat interior of conduit and condulet fittings with nominal 2 mil thick corrosion-resistant urethane finish.
6. Coat threads with clear urethane finish.

C. Couplings:

1. Bond polyvinyl chloride coating to outer surfaces of couplings.
2. Extend polyvinyl chloride sleeve equal to outside diameter of uncoated conduit beyond both ends of coupling approximately 1 pipe diameter or 1-1/2 inches, whichever is smaller.
3. Provide minimum 40 mil thick coatings on couplings and sleeves.
4. Bond polyvinyl chloride coating to outer surface of conduit bodies and fittings.
5. Extend polyvinyl chloride sleeves from hubs.
6. Provide same coating thickness on conduit bodies, fittings, and sleeve walls as on couplings in length and thickness.
7. Coat covers on conduit bodies on both sides so covers are completely interchangeable.
8. Coat interior of conduit couplings, sleeves, and conduit bodies with corrosion-resistant urethane finish.

D. Ensure that inside of conduit bodies remain undisturbed during processing and retain manufacturer's finish.

E. Polyvinyl Chloride Coated, Mounting Hardware, and Associated Fittings:

1. All mounting hardware and associated fittings shall be polyvinyl chloride coated in accordance with the intent of reference NEMA RN-1.
2. The polyvinyl chloride exterior coating shall have a normal thickness of 40 mils (.040 inch) except where part configuration or application otherwise dictate.
3. All fasteners for polyvinyl chloride coated fittings and mounting hardware shall be of the Type 316 stainless steel.

F. Electrical Pullboxes: As specified in Section 16134.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with Supplier of sludge thickening equipment and provide pertinent raceways for power, instrumentation and control in accordance with equipment shop drawings. Also, provide conduits for communication wiring and interconnection between sludge thickener control panel and existing SCADA panel SP-3

B. Install conduit runs in accordance with schematic representation as indicated on the Drawings and as specified. Modify conduit runs to suit field conditions, as accepted by the ENGINEER.

C. Install conduit runs for lighting and receptacle circuits, for telephone and data outles whether or not indicated on the Drawings, for circuit numbers indicated on the Drawings.

D. Install straight and true conduit runs with uniform and symmetrical elbows, offsets, and bends. Make changes in direction with long radius bends or with condulet fittings.

E. Install conduit runs so that runs do not interfere with proper and safe operation of equipment and not block or interfere with ingress or egress, including equipment removal hatches.

F. Expose conduit runs in buildings and structures, unless otherwise indicated on the Drawings.

G. Securely fasten exposed conduits with clamps or straps. Run exposed conduit on walls and ceilings only, parallel to planes of walls or ceilings. Do not run conduit diagonally. Securely fasten exposed polyvinyl chloride-coated rigid steel conduits with Type 316 stainless steel clamps or straps.

H. Use flexible conduit for short lengths required to facilitate connections between rigid conduit and motors, vibrating equipment, or control equipment. Maximum length shall be per NEC, Article 350.

I. Support conduit runs on water-bearing walls 1 inch away from wall on an accepted channel. Use hot-dip galvanized steel or stainless steel channels, consistent with type of conduit being installed unless otherwise indicated on the Drawings. Do not run conduit in water-bearing walls unless otherwise indicated on the Drawings.

J. Encase underground conduit runs, including conduit runs below slabs-on-grade, in a concrete envelope as specified in Section 03300 and indicated on the Drawings.

K. Install underground installations of direct buried cable, conduit, or other raceways to meet minimum cover requirements of NEC Table 300-5 and Table 710-4(b). Exceed minimum NEC requirements where indicated on the Drawings or specified.

L. Thoroughly ream conduit after threads have been cut to remove burrs. Seal joints with accepted conductive sealant compound and make watertight. Set up joints tight. Use bushings or conduit fittings at conduit terminations.

M. Install runs between pull boxes or junction boxes with total bends equaling not more than 270 degrees. Install NEC required pull boxes at locations acceptable to the ENGINEER. Plug conduits brought into pull boxes, manholes, handholes, and other openings until used to prevent entrance of moisture. Cap spare conduits and provide plastic pulling tape below threaded cap. Provide bonding bushing and bond wire.

N. Provide appropriate hangers, supports, fasteners, and seismic restraints to suit applications.

O. After complete installation of 2 inch and larger conduit runs, snake conduits with conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of conduit. Remove and replace conduits through which mandrel will not pass.

P. Clean and ensure that new and existing conduit runs are not crushed or creased. Verify internal dimensions of existing conduit prior to installation of conductors. Verify that no foreign objects or obstructions are present in conduit prior to installing conductors.

Q. Install conduit system to provide firm mechanical assemblies with electrical conductivity throughout.

R. Install expansion fittings across expansion joints and at other locations where necessary to compensate for thermal or mechanical expansion and contraction as indicated on the Drawings.

S. Install conduits complete between outlets, boxes, and circuit source before conductors are installed.

T. Install minimum 2 inch ductbank raceways, unless otherwise indicated on the Drawings.

U. Make ductbank raceway to external conduit size transitions at pullboxes and manholes.

V. Install spare conduits in underground duct banks towards top center of runs to allow for ease of installation of future cables as conduits enter underground manholes and pullboxes.

W. Install conduit thruwall seals where underground conduits penetrate walls and at other locations as indicated on the Drawings.

X. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with duct sealing compound.

Y. Where conduits, wireways, and other electrical raceways pass through fire partitions, firewalls, smoke partitions, or floors, install a fire stop that provides an effective barrier

against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.

Z. Provide 1/4-inch polypropylene pull line in each empty electrical conduit.

AA. Open-ended conduits containing SO (or similar) cable that continues outside the conduit to the utilization equipment shall be sealed with conduit sealing bushings.

BB. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc., shall be sealed with “Duxseal” as manufactured by Manville or seal fitting to prevent the accumulation of condensation.

CC. Conduits terminating at a wireway shall be supported independently from the wireway. Provide a conduit support within 1 foot of the wireway. The weight of the conduit shall not bear on the wireway.

DD. Rigid galvanized steel conduits which have been field cut and threaded shall be painted with cold galvanizing compounds. Provide polyvinyl chloride coating to match original on field cut threads for polyvinyl chloride coated rigid galvanized steel conduit.

EE. PVC-coated galvanized rigid steel elbows shall be used for pad-mounted transformer stub-ups.

FF. Underground conduits shall be temporarily sealed to prevent intrusion of foreign material before conductors are installed.

GG. Provide a protective liquid tight flexible nonmetallic conduit for isolation of low voltage wiring installed in underground vaults or pull boxes and install it on low voltage cable rack separate from power cable rack.

3.02 POLYVINYL CHLORIDE-COATED RIGID STEEL

A. Attach cover to conduit body with Type 316 stainless steel screws.

B. Where patching is required, apply 40 mil thick polyvinyl chloride coating in accordance with manufacturer's instructions.

3.03 RIGID NONMETALLIC POLYVINYL CHLORIDE

A. Reinforce encasement as indicated on the Drawings. Install conduit supports at 30-inch intervals.

3.04 CONDUIT SEALS

A. Install conduit entering or leaving NEC Article 500 hazardous areas with conduit seals.

B. Install conduit entering or leaving chlorination facilities, or areas of buildings in which chlorine storage or distribution equipment is located with conduit seals.

C. Install conduit seals in other hazardous locations as required by NEC.

D. Provide drains on conduit seals in locations where water condensation and accumulation is likely to enter a device or enclosure.

3.05 SCHEDULES

A. Conduit Sizes: In accordance with NEC, unless otherwise indicated on the Drawings or specified as follows:

1. Concealed Conduit in Partitions or Accessible Ceilings: Minimum 3/4 inch.
2. Exposed Conduit: Minimum 3/4 inch.
3. Rigid Steel Encased in Concrete: Minimum 1 inch.
4. Rigid Non-Metallic Polyvinyl Chloride Encased in Concrete: Minimum 2 inches.
5. Direct Buried Conduit Size: Minimum 2 inches.

B. Conduit Uses and Applications:

1. Rigid Steel Conduit: Typical, Exposed Indoor Conduit Runs in dry and non-corrosive locations, unless otherwise noted.
2. Liquid Tight Flexible Conduit: Final motor and instrument connection in non-hazardous areas.
3. Polyvinyl Chloride-Coated Rigid Steel Conduit: Entering or exiting concrete including minimum 12 inches above and below grade or finished floor, in corrosive NEMA 4X designated areas, plus exposed outdoor locations, and where indicated on the Drawings.
4. Aluminum Conduit: Outdoor exposed conduit runs including minimum 6 inches above grade or finished floor, in corrosive NEMA 4X designated areas, plus exposed outdoor locations, and where indicated on the Drawings.
5. Rigid Nonmetallic Polyvinyl Chloride Conduit: Runs concealed underground or concrete encased in walls, floors, and underground duct banks.
6. Explosion Proof Flexible Conduit: Final connection of equipment in hazardous areas.

3.06 FIELD CONDITIONS AND RELATED REQUIREMENTS

A. Underground water table may be near or above the location of new ductbanks.

B. CONTRACTOR shall include cost for necessary dewatering, cleaning equipment to perform work in underground ductbanks, pull boxes and manholes, prior to installation of required new conductors.

3.07 RACEWAYS SUPPLEMENTAL REQUIREMENTS

A. CONTRACTOR shall include necessary raceways and supports to provide any and all motorized equipment, electrical outlets, fixtures, communication outlets, instruments and devices within 10 linear feet of location shown on the Drawings.

B. CONTRACTOR shall include necessary raceways, trench, excavation, backfill, and related materials to provide any and all pull boxes, manholes and ductbanks within 20 linear feet of location shown on the Drawings.

C. Prior to installation of any raceway or related items identified in paragraphs A and B above, the OWNER shall have the right to make reasonable changes related to preferred location, at no additional cost.

D. CONTRACTOR shall provide necessary raceways for all equipment specified, identified in wiring schedules, equipment schedules, panel boards schedules, electrical single line diagrams, block diagrams, process and instrumentation diagrams (P&IDs), fixtures schedules, and devices. Said necessary conduits may not be shown on the plan drawings, but they shall be sized by CONTRACTOR in accordance with requirements specified and the National Electrical Code, and include in this allowance, the raceways necessary for the installation of the conductors and for the complete operation of the included device or equipment.

3.08 RACEWAYS IDENTIFICATION

A. Each new conduit, new wireway, and new boxes shall be identified by a specific number. The numbering system shall be in accordance with identification named on the Drawings or the process equipment identification. Products for identification of raceways is specified in Section 16075.

END OF SECTION

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SECTION 16134 BOXES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Outlet boxes, device boxes, metallic pull boxes, junction boxes, termination boxes and precast small handholes.
2. Fasteners used with wiring devices.

1.02 REFERENCES

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):

1. OS1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
2. OS2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

B. National Electrical Code (NEC):

1. Article 370 - Outlet, Device, Pull and Junction Boxes, Conduit Bodies and Fittings.

C. National Electrical Safety Code (NESC)

D. National Electrical Manufacturers Association (NEMA):

1. NEMA FB1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
2. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).

1.03 SUBMITTALS

A. Product Data.

B. Shop Drawings: Include identification and sizes of pull boxes for ENGINEER's acceptance prior to fabrication and installation.

C. Submit structural calculations and construction details of each underground handholes, with plan view and sections showing dimensions.

1. Submit statement of compliance with the requirements of applicable codes.
2. Submit the proposed locations for cable racks.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Device Boxes, Metallic Pull Boxes and Junction Boxes: One of the following or equal:

1. Crouse-Hinds.
2. Appleton.
3. O - Z Gedney.

B. Floor Outlet Boxes with 1 Inch Conduit Knockouts: One of the following or equal:

1. Steel City, 640 Series.
2. Hubbell.

C. Precast Handholes: One of the following or equal:

1. Old Castle Precast
2. Brooks Products
3. Utility Vault Company

2.02 DEVICE BOXES AND JUNCTION BOXES

A. Materials: Heavy-duty rigid steel or rigid copper free aluminum, compatible with the location and conduit system being used, unless otherwise specified or indicated on the Drawings.

B. For Indoor or Non-corrosive Areas: Provide cast FD type device boxes with epoxy finish, and compatible with the location and conduit system being used.

C. For Outdoor Locations, Corrosive Areas, or Wet Process Locations: Provide cast FD type boxes with PVC coating for outdoor locations, corrosive areas and wet process locations and compatible with the location and conduit system being used.

D. Coverplates:

1. Indoor: Provide lighting switch and receptacle boxes of Type 302 stainless steel cover plates with cover gaskets, except where otherwise specified or indicated on the Drawings. Provide other boxes with Type 304 stainless steel cover screws and with cover gaskets.
2. Outdoor and Corrosion Resistant: Provide lighting switch and receptacle boxes, weatherproof with yellow fiberglass lift cover plates with cover gaskets.

2.03 FLOOR OUTLET BOXES

A. Suitable for receptacles, communications and data outlets as specified and indicated on the Drawings, complete with gaskets and cover plates.

B. Dual-gang, heavy-duty cast iron, suitable for wiring devices to be installed to make a complete and operable system and installation.

2.04 CONCRETE HANDHOLES BOXES

A. Precast concrete handholes in locations indicated on the Drawings and as required by NEC, and National Electrical Safety Code (NESC)

B. Designed for heavy traffic conditions, with pull box and cover designed for heavy traffic bridge loading.

C. Minimum 2 feet by 3 feet by depth as necessary for conduit depth, or larger dimensions shown on pull box schedule.

D. Constructed of reinforced Class A concrete.

E. Identification: Furnish covers with "Electrical" engraved on top side.

F. Handholes with Metallic Covers:

1. The heavy duty covers shall include a spring loaded mechanism to facilitate opening. Also, the metal covers shall include a foam insulation layer in the interior,to minimize the radiation of exterior sun heat towards the interior of the box.

G. Pulling Eyes: Secured to reinforcement on interior walls.

H. Provide fiberglass cable racks with adequate supports on pull boxes.

2.05 METALLIC PULL BOXES

A. Boxes for applications in dry and non-corrosive location:

1. Fabricated from 11 gauge (minimum) steel or aluminum, completely weatherproof with gasketed removable covers; compatible with type of conduit systems being used; manufactured, furnished, and installed complete with grounding lug.

B. Boxes for applications in wet areas, outdoor locations and NEMA 4X designated areas: Fabricated from 11 gauge, 316 stainless steel, with gasketed covers and labeled NEMA 4X. Boxes shall include a drain fitting to facilitate continuous draining of moisture condensation.

2.06 FASTENERS

A. Electroplated or stainless steel in boxes with wiring devices.

B. Screws, Nuts, Bolts, and Other Threaded Fasteners: Stainless steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with the National Electrical Code.

B. Terminal blocks installed in junction/terminal boxes as specified in Section 16050.

C. Install concrete handholes on 12 inches of compacted clean aggregate base course, and in such a manner that the cover of the pull box will be 2 inches above and sloped with finish grade.

1. Route signal cable such as instrumentation and communication cables separate from power and control cables.
2. Identify cables and conductors in pull boxes.
3. Provide ties on all conductors, to prevent interference and damage during work access.
4. Install surveyor markings to establish finish grade.
5. Provide seals on box covers to minimize water leakage from grade into box.

D. Provide weatherproof conduit hubs for all conduit connections to metallic pull boxes.

E. Phosphatize and prime with rust-resistant paint metallic pull box surfaces. Finish shall be 2 coats of ANSI 61 gray enamel paint.

F. Size pull boxes to meet National Electrical Code requirements and to provide sufficient room for the future conduits and cables indicated on the Drawings.

G. Furnish and install pull boxes as indicated on the Drawings and as specified. Install additional pull boxes as required to meet cable manufacturer's pulling tension requirements.

H. Install pull boxes such that access to them is not restricted by obstructions such as pipes, valves, ladders.

I. Secure metallic pull box covers with Type 316 stainless steel screws or bolts with coated threads.

J. Provide adequate supporting pillar(s) for boxes to be located above ground or above decks, where there is no structural wall or surface for box mounting.

END OF SECTION

SECTION 16135 CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cabinets and enclosures to house electrical controls, instruments, terminal blocks, and similar equipment.

1.02 REFERENCES

A. National Electrical Code (NEC).

B. National Electrical Manufacturers' Association (NEMA).

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Unless otherwise specified or indicated on the Drawings, enclosures to house electrical controls, instruments, terminal blocks, and similar equipment shall be NEMA 12 for indoor, dry and non-corrosive locations; and NEMA 4X - 316 stainless steel painted white for outdoor installations, wet locations and corrosive designated areas and shall be compatible with the conduit system being used.
2. Provide sunshields with adequate supports for equipment enclosures that contain electronic equipment.
3. Provide air conditioning heat exchangers for control cabinets that contain electronic equipment or other temperature sensitive equipment not rated for ambient temperature greater than 40 degrees Celsius.
4. Specific control panel enclosures shall be as specified in Division 17 of these Specifications or as indicated on the Drawings.

1.04 SUBMITTALS

A. Product Data.

B. Calculations:

1. Conditioning System Sizing: Submit calculations.

1.05 WARRANTY

A. Submit manufacturer's standard warranty.

1.06 SUBMITTALS

A. Submit product data and mounting supports.

B. Air conditioning data when applicable, including sizing calculations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. NEMA 12 Steel Enclosures: One of the following or equal:

1. Hoffman Engineering Company.
2. Rittal.

B. NEMA 4X Stainless Steel Painted White Enclosures: One of the following or equal:

1. Hoffman Engineering Company.
2. Henessy Products Inc.
3. Carlon.

C. NEMA 3R Enclosures:

1. Hoffman Engineering Company.
2. Rittal.

D. Enclosure Air Conditioner: One of the following or equal:

1. Hoffman Engineering Company.

2.02 FABRICATION

A. NEMA 12 Steel Enclosures:

1. Fabricate enclosures from 14 gauge steel with continuous welded seams.
2. Doors: Doors shall have full length piano hinges with the door removable by pulling the hinge pin.
3. Provide a rolled lip around 3 sides of the door and around all sides of the enclosure opening.
4. Gaskets: Attach gasket with oil-resistant adhesive and hold it in place with steel retaining strips.
5. Provide hasp and staple for padlocking.
6. Provide a print pocket for each enclosure.

B. NEMA 4X Stainless Steel Enclosures:

1. Provide enclosures that consist of base and cover which shall be of Type 316 stainless steel with minimum thickness of 12 gauge and with white coating to reflect sunlight heat. The enclosures shall be provided with cover hinges to form a weathertight seal between the cabinet and door.

C. NEMA 3R Enclosures:

1. Enclosures shall be of minimum 14 gauge steel construction with continuous welded seam, gasket door with continuous hinges and stainless steel cover bolts and painted with adequate white coating to reflect sunlight heat.
2. Enclosures shall be custom built for specific application and provided with ample space for mounting and wiring electrical equipment.

2.03 FINISHES

A. Steel Enclosures:

1. NEMA 4X enclosures. Door fronts shall be ground smooth.
   a. Print pockets and interior panels shall be steel with a white enamel finish.
2. Provide NEMA 12 and NEMA 4X enclosures with white enamel interior finish: The finish shall be light gray enamel, ANSI 61 exterior, over phosphatized surfaces. Panels shall be white enamel.
3. Special finishes and colors shall be furnished for wet locations.

B. Other portions of these Contract Documents shall be checked for special conditions.

2.04 ENCLOSURE AIR CONDITIONERS

A. Provide electrical equipment enclosures with complete air conditioning system as indicated on the Drawings and as specified.

1. Enclosures to be climate controlled, equipped with integral self-contained air conditioning units complete with thermostats.
2. The industrial grade air conditioners to constantly cool and recirculate the internal enclosure air which is kept completely separated from the external, or ambient air (closed-loop system).
3. Provide units suitable for operation in the environment as specified in Section 16010. The units to be complete with all gaskets, mounting hardware, and air inlet filter.

B. Electrical Requirements:

1. Power supply to the air conditioners to be as indicated on the Drawings.
2. Make adjustments to the power supply circuits (conduits and wires and other components) as necessary to accommodate the air conditioning equipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner. Install in accordance with Section 16050.

C. Install cabinet fronts plumb.

D. Top mounted air conditioning units installation shall not allow condensation to damage electrical equipment or enclosure.

E. Provide size of pull boxes to meet National Electric Code requirements and ample space for conductors and devices.

F. Provide adequate supports and anchors to resist seismic forces.

G. Provide adequate supporting pillar(s) for cabinets to be located above decks, above slabs or where there are no structural wall or surface for cabinet mounting.

END OF SECTION

SECTION 16140 WIRING DEVICES

PART 3 GENERAL

3.01 SUMMARY

A. Section Includes: Wiring devices including the following:

1. Snap switches and toggle switches.
2. Fluorescent dimmer switches.
3. Plugs and receptacles.
4. Control and push-button stations.
5. Pilot devices.

3.02 SUBMITTALS

A. Product Data.

3.03 QUALITY ASSURANCE

A. Provide industrial grade products for wiring devices. Commercial grade products are not acceptable, unless otherwise specified or indicated on the Drawings.

B. Coordinate lighting fixture ballasts with dimming switches.

PART 4 PRODUCTS

4.01 SNAP OR TOGGLE SWITCHES

A. Manufacturers: One of the following or equal:

1. Hubbell.
2. General Electric.
3. Leviton.
4. Bryant.

B. Number of Poles: As indicated on the Drawings.

C. Rating: 20 amperes, 125 volt.

D. Special Switches and Covers: As specified or indicated on the Drawings.

4.02 FLUORESCENT DIMMER SWITCHES

A. Manufacturers: One of the following or equal:

1. Hunt.
2. Lutron.
3. Leviton.
4. Bryant.

B. Circuitry: Built-in, solid state, able to compensate for line voltage dips, with an on-off switch.

C. Rating: For operation of minimum 40 watt rapid start lamps at 120 volts.

4.03 120 VOLT RECEPTACLES

A. Manufacturers: One of the following or equal:

1. Hubbell.
2. General Electric.
3. Leviton.
4. Bryant.

B. Duplex Receptacles: 2-pole, 3-wire, grounded, 125 volts, industrial, rated at 20 amperes.

1. Special Receptacles and Covers: As specified in Section 16134 or as indicated on the Drawings.

C. Ground Fault Interrupter Receptacles (GFI): Rated at 20 amperes at 125 volts alternating current.

4.04 240 VOLT RECEPTACLES

A. Manufacturers: One of the following or equal:

1. Hubbell.
2. General Electric.
3. Leviton.
4. Bryant.

B. Types: Single and 3-phase; suitable for equipment served.

C. Rating: 20 amperes at 250 volts alternating current, unless otherwise indicated on the Drawings**.**

4.05 480 VOLT PLUGS AND RECEPTACLES

A. Manufacturers: One of the following or equal:

1. Killark W Series.
2. Crouse-Hinds.
3. Leviton.
4. Bryant.

B. Types: Heavy duty, 3-phase, weather resistant, grounding type, 4-wire, 4-pole device, suitable for equipment served.

C. Rating: 30 amperes at 480 volts alternating current, unless otherwise indicated on the Drawings or specified.

4.06 DISTRIBUTED CONTROL SYSTEM RECEPTACLES

A. Manufacturers: One of the following or equal:

1. Hubbell.
2. Square D Company.
3. Leviton.
4. Bryant.

B. Type: Surge suppression/isolated ground, red, minimum 20 amperes rated at 125 volts alternating current, with gasketed cover plate.

4.07 UNINTERRUPTIBLE POWER SYSTEM RECEPTACLES

A. Manufacturers: One of the following or equal:

1. Hubbell.
2. Square D Company.
3. Leviton.
4. Bryant.

B. Type: Surge suppression/isolated ground, orange, minimum 20A rated at 125 volts alternating current, with gasketed cover plate.

4.08 LOCAL PUSH-BUTTON MOTOR CONTROL STATIONS

A. Manufacturers: One of the following or equal:

1. Furnas Electric Company.
2. Square D Company.
3. Allen-Bradley.
4. Siemens.
5. Cutler-Hammer.
6. General Electric.

B. Types: Heavy duty, oiltight/watertight.

C. Components: Selector Switches, pilot light, and push buttons.

D. Enclosures: As follows, unless otherwise indicated on the Drawings or specified:

1. For Nonhazardous Indoor Locations: NEMA 12.
2. For Hazardous Indoor Locations: NEMA 7.
3. For Outdoor Locations: NEMA 4X or NEMA 3R, as designated on Drawings.
4. For Hazardous Outdoor Locations: NEMA 4 and NEMA 7.
5. In Chemical Building, and areas designated NEMA 4X on Drawings: NEMA 4 and NEMA 4X, stainless steel.

E. Field Located Maintained Push Buttons: Red mushroom head, push-to-stop, pull-to-reset, with maintained contacts.

4.09 PILOT DEVICES

A. Manufacturers: One of the following or equal:

1. Furnas Electric Company.
2. Square D Company.
3. Allen-Bradley.

4. Siemens.
5. Cutler-Hammer.
6. General Electric.

B. Type: Heavy duty, suitable for mounting in control stations, on switchgear, switchboards, variable frequency drives, motor control centers, control panels, and other electrical equipment.

C. Components: Oiltight/watertight push buttons, selector switches, LED pilot light, and incidental items.

D. Casting: Durable 1 piece with chrome plated octagonal mounting nuts.

E. Push Buttons: Heavy-duty plastic.

F. Pilot Light Lenses: Shatter resistant plastic, push-to-test.

G. Potentiometer, 20 turn, 10k to match VFD manufacturers requirements.

4.10 CORD CONNECTOR GRIPS

A. Non-Hazardous Areas:

1. Manufacturers: One of the following or equal:
   a. Killark, Series Z.
2. Aluminum cord connector.
3. Stainless steel mesh grip.

B. Hazardous Areas:

1. Manufacturers: One of the following or equal:
   a. Killark, Series ZE.

PART 5 EXECUTION

5.01 INSTALLATION

A. Install wiring devices in accordance with manufacturer's instructions.

B. Mount wiring devices as indicated on the Drawings**.**

1. Provide adequate supporting pillars for wiring devices to be located above ground or above decks, where there is no structural wall or surface for box mounting.

5.02 LOCAL PUSH-BUTTON MOTOR CONTROL STATION INSTALLATION

A. Install Start-Lockout-Stop push-button control stations adjacent to every motor unless otherwise indicated on the Drawings.

5.03 PROTECTION

A. Protect products until acceptance by OWNER.

END OF SECTION

SECTION 16144 DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Fusible and nonfusible disconnect switches for sludge feed pump, thickened sludge discharge pump, actuator for thickener's sludge feed valve and disconnect switches for polymer feed system.

1.02 SUBMITTALS

A. Product Data: Include manufacturer's specifications and description.

1. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

B. Shop Drawings.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.03 WARRANTY

A. Submit manufacturer's standard warranty.

1.04 MAINTENANCE

A. Spare Parts: Furnish 1 set of spare fuses for each fused disconnect switch.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Disconnect Switches: One of the following or equal:

1. Square D Company.
2. Cutler-Hammer.
3. General Electric.
4. Siemens.

2.02 DISCONNECT SWITCHES

A. Type:

1. Heavy-duty safety switches with a quick-make, quick-break operating mechanism, full cover interlock and indicator handle.
2. Where required, furnish with fuses where indicated on the Drawings.
3. Provide auxiliary contact for VFD applications as indicated on the drawings.

B. Unless otherwise specified herein or indicated on the Drawings, disconnect switches shall be in NEMA 12 enclosures for indoor installations and in NEMA 4X enclosures with 316 stainless steel material for outdoor installations, as designated on Drawings.

1. Disconnect switch enclosures shall be compatible with type of conduit system being used.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install devices in accordance with manufacturer's instructions and accepted shop drawings.

B. Provide adequate supporting pillar(s) for disconnect switches to be located above ground or above decks, where there is no structural wall or surface for box mounting.

END OF SECTION

SECTION 16262 VARIABLE FREQUENCY DRIVES BELOW 75 HORSEPOWER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Complete, solid-state variable frequency drive (VFD) unit(s) and VFD system(s) including design, fabrication, software, technical data, spare parts, testing, installation and support requirements for speed control of 3-phase squirrel cage rotor, induction motors, for control of sludge feed pumps and thickened sludge discharge pumps.

1. The enclosure of new VFD and maintenance bypass starter shall fit in existing available limited space of the blower /MCC building No. 3. Verify available wall space dimensions prior to submitting pertinent equipment shop drawings.

B. Related Sections:

1. Section 11230 – Gravity Belt Thickener
2. Section 11240 – Sludge Feed Pumps
3. Section 16010 - Electrical Requirements.
4. Section 16075 - Electrical Identification.
5. Section 16422 - Motor Control.
6. Section 16950 - Electrical Testing.
7. Section 17010 - Basic Measurement and Controls
8. Section 17452 - Programmable Logic Controller System

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA):

1. Standard 250 - Enclosures for Electrical Equipment (1,000 volts maximum).
2. NEMA MGI, Part 31 - Motors with higher peak voltage capability.
3. NEMA ICS7 – Industrial Controls and Adjustable Speed Drives.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. Standard 519 - 1992 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

C. Underwriters' Laboratories, Inc. (UL):

1. UL label is required on VFD unit
2. UL 508 – Industrial Control Equipment
3. UL 508 label is required on VFD equipment and enclosure assembly
4. UL 50 – Enclosures for Electrical Equipment

1.03 SYSTEM DESCRIPTION

A. The CONTRACTOR and variable frequency drive system Supplier are cautioned regarding the review and compliance with the total Contract Documents. Typical required auxiliary devices may include circuit breakers, motor circuit protectors, relays, timers, pilot devices including pushbuttons, selector switches and pilot lights, enclosures, conduit, disconnect switches, terminal boxes, and other equipment. These auxiliary items may be provided by separate supplier; however, they shall be integrated as complete VFD working system.

B. See Division 11 for a control description and verify data of the motors and driven equipment including full load current, torque, speed, and performance requirements and provide all supplementary equipment and services to accomplish the necessary operation.

1.04 SUBMITTALS

A. Shop Drawings:

1. General non-specific "catalog data" are not acceptable.
2. Layout drawings of each VFD in control cabinet or separate enclosure dimensions, access details, weights, arrangement, color, and nameplates, door mounted devices and conduit stub-ups.
3. Internal VFD schematic and interconnection wiring diagrams among internal devices, external devices including terminal blocks, and wire numbering.
4. Specific equipment names, relay and timer coil, respective contact identification numbers shall be consistent with the design Drawings.
5. Complete single line diagrams including, but not limited to, electrical ratings, circuit breakers, motor circuit protectors, contactors, instrument transformers, meters, relays, timers, control devices, and other equipment comprising the complete system.
6. Complete Bills of Material and catalog data sheets for all equipment and devices.
7. Complete drawings to provide the OWNER with operations and maintenance capabilities.

B. Product Data:

1. Functional diagrams that identify major system functional blocks and interfaces.
2. Special requirements or restrictions of the motor-load combination that may result from operation on the VFD.

C. Test Reports:

1. Submit certified copies of field test reports verifying adequate performance.
2. Submit factory standard bench-test data verifying that the manufacturer's proposed equipment has been tested after product assembly.

D. Operation, Maintenance and Installation Instructions.

E. Guides and Manuals: If the variable frequency drive systems require settings or configuration, provide copies of all settings.

F. Record Drawings:

1. Drawings of each VFD type representing the as-built condition of the equipment and respective settings. Final or corrected as-built drawing shall be delivered 4 weeks after field system acceptance.

G. Warranty documents.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Variable frequency drive manufacturer shall maintain, as part of a national network, engineering service facilities within 150 miles of the equipment installation to provide quick responsive start-up service, training of customer personnel, periodic maintenance service contracts, and emergency troubleshooting and repair service.
2. The manufacturer shall have produced the specified type of VFDs for a minimum period of five (5) years.

1.06 WARRANTY

A. Contractor and manufacturer shall warrant that the material and workmanship of all components, and the operation of the VFD system shall be free of any limitations and deficiencies. Also, the warranty shall include:

1. Replace components found to be faulty and make changes in equipment, substitution arrangement, include system rewiring, rebuilt or additional equipment required, or adjustments necessary during trial operation or subsequent operation of the unit during the warranty period, to meet the equipment or functional requirements of this Specification.

1.07 MAINTENANCE

A. Spare Parts: As a minimum, provide the following spare parts:

1. One complete main control key pad for each type and rated size of VFD.
2. Any special dedicated tool for emergency service and troubleshooting.

B. Field Services: Manufacturer shall describe the field service system available to support the proposed variable frequency drive system. As a minimum describe:

1. Type of technical support available (e.g. system engineering and technician).
2. Location of field service personnel.
3. Field service daily rates in dollars per hour and dollars per day.
4. Guaranteed response times to service requests.

C. Local Service Representative:

1. Provide cell phone number and office phone numbers of local service and parts contacts for emergency repairs and callouts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schneider (Square D.), to match existing controllers for Feed Pumps.

B. Yaskawa Products, to match VFD products installed in Manatee County Water Reclamation Facilities.

2.02 GENERAL REQUIREMENTS

A. VFD system shall be rated for the following:

1. Supply the amperage demand and speed control of motor size(s) scheduled or indicated on the Drawings.
2. Maintain output frequency (setpoint) with a steady state accuracy of 0.5 percent of rated frequency of 60 hertz for a 24 hour period.
3. Provide smooth, stepless changes in motor speed, acceleration and deceleration over the entire operating speed (revolutions per minute) range.
4. Automatic current limit feature during startup and provide a "soft start" torque profile for the motor-load combination. Also, it shall limit current due to motor winding or motor lead phase-to-phase short circuit or phase-to-ground short circuit. The current limit protection setting shall be field adjustable and it shall withstand available short circuit currents of the operating environment.
5. Operate the motor load continuously within the range of 10 percent to 105 percent of rated speed. The minimum and maximum continuous operating speeds shall each be field adjustable setpoints within this speed range. Provide 2 field-adjustable speed setpoints for the variable frequency drive to skip equipment resonant frequencies.
6. VFD shall have linear acceleration capability to ramp up the speed, in revolutions per minute, of the selected minimum to maximum operating speed range in a maximum of 30 seconds. Provide controlled linear deceleration capability. The acceleration and deceleration time limits shall be field adjustable to values up to 120 seconds.
7. VFD shall be capable of supplying indefinitely 110 percent of the motor nameplate full load current. Also, the unit shall have a one (1) minute overload current rating of 150 percent of the motor nameplate full load current.

B. The VFD unit overall efficiency shall be a minimum of 95 percent at rated voltage, frequency, and current. This efficiency shall be calculated as follows:

$$Efficiency \quad (\%) = \frac{Power \quad (Load)}{Power \quad (Supply)} \; x \; 100$$

Power (Load) is the total 3-phase power measured at the output terminals of the drive system, including VFD, output filters or transformers. Power (Supply) is the total power measured at the input terminals of the VFD including input filters, line reactors, isolation transformers, harmonic distortion attenuation equipment and auxiliary equipment (e.g., controls, fans) for complete system operation.

C. The VFD and/or protective relay system shall continuously monitor the output voltages and generate an alarm condition when the unbalance exceeds 1 percent. The system shall detect and generate a separate alarm for loss of any output phase voltage (single phasing). Phase unbalance shall be as defined by NEMA Standard MG-1.

D. VFD shall operate continuously without interruption of service or damage to equipment during transient input voltage variations of minus 40 percent for a duration of 15 cycles. Unacceptable voltage fluctuations on the supply bus shall cause under or over-voltage protection to trip and remove supply voltage from the drive system.

E. Each VFD unit for the Sludge Feed Pump No. 5 and Thickened Sludge Discharge Pump No. 2 shall include a maintenance bypass switch and motor starter, pertinent control features.

2.03 SYSTEM FEATURES AND CHARACTERISTICS

A. VFD system shall have microprocessor based controls it shall include the following:

1. Input section rectifier shall consist of a 6-pulse full wave diode system and direct current link.
2. The inverter shall use insulated gate bipolar transistors (IGBTs) with space vector pulse width modulation (PWM) technology. The inverter shall invert the direct current voltage into an alternating current voltage at a frequency which shall be proportional to the desired speed. This alternating current voltage and frequency shall both vary simultaneously at a constant "Volts-Per-Hertz" ratio to operate the induction motor at the desired speed.

B. VFD output voltage regulation shall be plus or minus 2 percent and carrier frequency shall be field-adjustable.

C. Controls and indicators to accomplish VFD mode operation functions shall be located on the VFD. As a minimum, the required controls and indicators shall consist of the following features via the keypad or auxiliary devices:

1. Local / Remote Key type selector Switch
2. Digital Output Speed Indicator: Revolutions per minute.
3. Variable Frequency Drive Mode Indicator: ON-OFF-TEST.
4. Input Voltage:
5. Output Voltage:
6. Output Current:
7. Output Frequency:
8. Drive Ready Indicator.
9. Power On indicating Light
10. Pump running indicating light
11. Running time meter.
12. Control Mode Selector Switches: As required .
13. Manual speed control and HAND-OFF-AUTO selector switch.
14. Alarm Read-Out: Display on keypad.
15. Alarm reset button.
16. Alarm, Auxiliary Contacts and Other Devices: as indicated on the Drawings.
17. Molded case circuit breaker disconnect with lockout mechanism

D. Controls and indicators to accomplish VFD bypass operation functions shall be located on the VFD. As a minimum, the required controls and indicators shall consist of the following features via auxiliary devices:

1. VFD – OFF- Bypass type selector Switch.
2. Pump reset push button.
3. Pump fail indicating light
4. Power on indicating light
5. VFD mode indicating light
6. Bypass mode indicating light
7. Pump's high pressure indicating light

E. VFD system shall provide a 4 to 20 milliamperes direct current output signal that is proportional to the drive output frequency for use as speed feedback or control and remote speed indication.

F. VFD system shall accept a 4 to 20 milliamperes direct current input command signal to control the output frequency in the automatic and/or manual control modes. The controls shall accept the input increase/decrease command with a resolution that permits incremental changes in speed, revolutions per minute, equal to or less than 0.1 percent of rated speed.

G. When operating in the automatic mode, the VFD system shall shut down during a power outage. Upon restoration of normal power and after an adjustable time delay (0 to 2 minutes; motor has coasted to zero speed and there is no backspin), the VFD system shall automatically restart and then ramp up to speed as required by the control system. The process operator shall not be required to reset the system manually after a shutdown caused by a power outage.

H. Furnish door mounted selector switch or keypad pilot device for selection of local/remote speed reference signal (e.g., analog output from a programmable logic controller) supplied to the VFD.

I. Include in each variable frequency drive system an automatic trip feature which will remove the drive output from the motor and allow it to decelerate safely. This automatic system shall trip and indicate the fault only upon the following conditions:

1. Motor overload.
2. Motor stator winding fault (phase-to-ground, phase-to-phase).
3. Loss of input power to the variable frequency drive or unacceptable voltage variation.
4. High variable frequency drive equipment temperature.

J. Provide each VFD system with transmitted and received radio interference protection. In addition, provide protection against starting a rotating motor, both directions (coasting to zero speed and backspin). In the event that a motor automatic restart feature (catch the motor "on-the-fly) is provided in the drive controller as standard, this feature shall be capable of being disabled.

K. VFD shall include on-line diagnostics with an automatic self-check feature, that will detect a failure which in turn affects motor operation and generates an alarm output, contact

rated for 125 volts-direct current.

1. Diagnostics shall operate a visual and audible alarm indicator(s) on the VFD cabinets without opening cabinet doors.
2. Diagnostics shall provide an easily readable output that will indicate a failure.

2.04 OPERATING CONDITIONS

A. The following operating conditions are applicable for all VFD equipment.

1. Utility Power Supply: 480 volts, 3-phase, fixed frequency of 60 hertz.
2. Suitable to operate, at times, on a limited power source with waveform distortion engine-generator set.
3. Short Circuit Fault Withstand: 65,000 amperes symmetrical at rated voltage.

2.05 ENCLOSURES

A. Unless otherwise specified or indicated on the Drawings, each VFD system enclosure shall be in NEMA 12, with 14 gauge steel, gasketed force ventilated dead front with front accessibility, and maximum dimensions per equipment layout on drawings. Design enclosures for bottom entry of power supply cables and top exit of motor cables. Design VFD system so that rear cabinet access is not required for operations, maintenance, and repair tasks.

1. Treat metal surfaces and structural parts by phosphatizing, or equal, prior to painting.
2. Apply a gun-metal gray undercoat to enclosures which is equal to zinc chromate.
3. Finish exterior of the enclosures in ANSI-Ivory color enamel.
4. Brace each door to prevent sag when fully open.

B. Main disconnecting means shall have external operating handle interlocked with the door so that it cannot be opened unless the disconnect is in the OFF position. Power supply to the motor from the VFD shall be capable of being positively locked out in the OFF position. The disconnect shall be interlocked so that equipment cannot be energized when the door is open.

C. Electrical ground bus shall be tin-plated copper. Power and control wiring shall be copper, and identified in accordance with Section 16075.

D. Equipment to be of modular construction allowing normal maintenance and repair to be done with ordinary hand tools. Design and install device assemblies so that a single failed item can be individually removed and replaced.

2.06 SOURCE QUALITY CONTROL

A. Factory Wiring Labels:

1. Provide all VFD internal wiring with identification numbers or labels and connected to terminal blocks:

B. Factory Testing:

1. Factory test each VFD system in accordance with IEEE and NEMA standards for operational integrity.

2. VFD system components, including power transistors, GTOs, SCRs, and diodes shall be 100 percent inspected, including temperature cycling and ambient high temperature of 65 degrees Celsius load testing. All integrated circuits shall be inspected, pass/fail tested, temperature cycled and ambient high temperature tested. Small components, including small signal semiconductors, resistors, capacitors, diodes, etc. shall be lot sampled and tested for functionality.
3. Auxiliaries, including fans, that are required for rated load operation at maximum ambient temperature, shall be 100 percent redundant. A new and unused spare replacement fan(s), shipped in original carton, may be acceptable.
4. VFD system shall not be shipped from the manufacturing and assembly facility until the acceptance tests are completed and the results approved by the test representative.
5. Acceptance of a shop test does not relieve CONTRACTOR from requirements to meet field installation tests under specified operating conditions, nor does the inspection relieve the CONTRACTOR of responsibilities.

PART 3 EXECUTION

3.01 GENERAL

A. Variable frequency drives rated below 75 hp shall be installed in NEMA 12 gasketed enclosure - control panels, to match existing control equipment for Sludge Feed pumps and in accordance with drawings.

B. Variable frequency drives for sludge thickener process equipment shall be installed within the thickener control panel and in accordance with drawings.

3.02 FIELD QUALITY CONTROL

A. The CONTRACTOR shall successfully complete Acceptance Test Procedures on the assembled drive system. The test plan shall be submitted for acceptance at least 30 days prior to the planned test date.

B. Provide the services of an experienced, factory trained technician or service engineer of the variable frequency drive manufacturer, for minimum of 2 days for VFD unit test and startup, beginning at a date mutually agreeable to the CONTRACTOR and the OWNER. The technician shall be on duty at the site for at least 6 hours per each required day of each VFD normal test and startup; and he shall be available 24 hours per day when required to advise concerning special problems with equipment and systems.

C. Include in the bid the training of personnel in the operation and maintenance of each furnished variable frequency drive pump control system. Training shall include 2 separate days - 4 hour sessions for 5 designated plant operators, plus 2 separate days - 4 hour sessions for 5 designated plant maintenance staff.

END OF SECTION

SECTION 16412 LOW VOLTAGE CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Low voltage circuit breakers as indicated on the Drawings and as specified.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA): Standards Publication No. AB1.

B. National Electrical Code (NEC): Article 430-52.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Circuit Breakers: Manufacturers: One of the following or equal:

1. Cutler-Hammer.
2. General Electric Company.
3. Siemens.
4. Schneider Electric / Square D.
5. Match the manufacturer brand in existing panelboards.

2.02 CIRCUIT BREAKERS - LOW VOLTAGE

A. Circuit Breaker Frame and Trip Ratings: As indicated on the Drawings and coordinated with the ratings of the equipment actually furnished. Modify ratings where necessary to suit this equipment and in accordance with the short circuit fault analysis and protective device coordination study.

B. Circuit Breakers for Motor Control Centers: As specified and indicated on the Drawings. Where no indication of type is given on the Drawings, the following governs:

1. When an integral part of a UL-listed combination controller: Motor circuit protectors.
2. All other circuit breakers: Molded case circuit breakers.

C. Provide motor circuit protectors and circuit breakers with non-aluminum line and load terminals suitable for the required conductor type, size, and number of conductors.

D. Panelboard Circuit Breakers: Bolt-in type. Snap-in circuit breakers are not acceptable.

2.03 MOLDED-CASE CIRCUIT BREAKERS

A. Molded-Case Circuit Breakers: Ambient compensating which provides inverse time delay overload and instantaneous short circuit protection by means of a thermal magnetic element. Accomplish compensation by a secondary bimetal that will allow the breaker to carry rated current between 25 degrees Centigrade and 50 degrees Centigrade with tripping characteristics which are approximately the same throughout this temperature range.

B. Circuit Breaker Ratings and Modifications: As indicated on the Drawings.

C. MCC Main Circuit Breaker shall be manually operated circuit breaker with electronic trip unit including adjustable longtime current setting, adjustable long time delay, adjustable short time pick-up, adjustable short time delay and frame size as indicated on the Drawings.

D. On Breakers with Interchangeable, Thermal, Adjustable Magnetic Trip: The accessibility and position of the adjustment knob shall not be changed from those on the standard breaker.

E. Circuit Breakers for Mounting in Motor Control Centers or for Separate Mounting: Air-break type, quick-make and quick-break, 600 volt, with number of poles as indicated on the Drawings. Minimum Frame Size: 100 amperes.

1. Provide each breaker pole with inverse time delay and instantaneous circuit protection.

F. Breakers: Operated by a handle and provided with a quick-make, quick-break switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents.

1. Tripping Due to Overload, Short Circuit, or Ground Fault: Clearly indicate tripping by the handle automatically assuming a position between the manual ON and OFF positions.
2. Latch Surfaces: Ground and polished.
3. Poles: Constructed so they all open, close and trip simultaneously.
4. Conform to the applicable requirements of NEMA Standard No. AB1.

G. Breakers: Completely enclosed in a molded case.

1. Non-Interchangeable Trip Breakers: Sealed covers.
2. Interchangeable Trip Breakers: Sealed trip unit to prevent tampering.
3. Ampere Ratings: Clearly visible.
4. Contacts: Non-welding silver alloy.
5. Arc Extinction: Accomplished by means of arc chutes.

H. Minimum Interrupting Ratings: At least equal to the available short circuit at the line terminals as determined by the CONTRACTOR's short circuit fault analysis and as accepted by the ENGINEER, but not less than 65,000 RMS amperes.

2.04 MOTOR CIRCUIT PROTECTORS

A. Motor Circuits: Protected by motor circuit protectors, as permitted by Item I below.

B. Motor Circuit Protectors: Operated by a handle and provided with a quick-make, quick-break switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuits.

1. Tripping: Clearly indicated by the handle automatically assuming a position between the manual ON and OFF positions.
2. Latch Surfaces: Ground and polished.
3. Poles: Constructed so they all open, close, and trip simultaneously.

C. Motor Circuit Protectors: Completely enclosed in a molded case.

1. Trip Unit: Sealed to prevent tampering.
2. Ampere Ratings: Clearly visible.
3. Contacts: Non-welding silver alloy.
4. Arc Extinction: Accomplished by means of arc chutes.

D. Provide each pole of motor circuit protectors with instantaneous short circuit protection by means of a single adjustable magnetic only element. The single adjustment screw is to adjust all poles simultaneously.

E. Furnish motor circuit protectors with provision for locking the maximum achievable trip setting to values less than maximum obtainable trip setting. Each adjustment typically to have 8 main setting points and mid-setting points following a linear scale so that each point has a significant value within calibration tolerances.

F. Motor Circuit Protectors: Suitable for use with current limiters, having 100,000 ampere interrupting capacity and a built-in trip indicator, that are fully coordinated with the motor circuit protectors so that the motor circuit protectors will open all 3 phases if the limiter operates.

1. Current limiters shall be so constructed that they can only be replaced by an identical or similar limiter having the same interrupting capacity.

G. Minimum Interrupting Rating: At least equal to the available short circuit current at the line terminals as determined by the CONTRACTOR's short circuit fault analysis, but not less than 65,000 RMS amperes.

H. Motor Circuit Protectors Continuous Current Rating: As specified herein or as indicated on the Drawings.

1. Setting: The motor circuit protectors setting shall be in accordance with the CONTRACTOR's protective device coordination study as accepted by the ENGINEER and in accordance with the motor circuit protectors manufacturer's recommendation based on motor nameplate current.

I. Utilize an instantaneous trip circuit breaker or motor circuit protector only as part of a listed combination motor controller which provides coordinated motor branch-circuit

overload, and short-circuit and ground-fault protection in accordance with NEC Article 430-52.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 16414 600 VOLT FUSES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: 600 volt class fuses.

1.02 REFERENCES

A. Underwriters' Laboratories, Inc. (UL):

1. I-508 Industrial Control Equipment.

B. International Electrotechnical Commission (IEC).

1.03 SUBMITTALS

A. Shop Drawings: Include drawings of spare fuse cabinet(s) and complete list of fuses indicating manufacturer, UL Class, and ampere rating for each location where fuses are to be installed.

B. Product Data: Include time-current and peak let-through curves for each class of fuse.

1.04 WARRANTY

A. Submit manufacturer's standard warranty.

1.05 MAINTENANCE

A. Spare Fuses:

1. Zero to 2,000 Amperes: 10 percent minimum, but not less than 3 of each size and type installed under any Division of these Specifications.
2. Over 2,000 Amperes: Minimum 3 of each type and size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fuses - 600 V and Accessories:

1. UL Class L Fuses: Manufacturers: One of the following or equal:
   a. KLPC by Littelfuse.
   b. KRP-C by Bussmann.
2. UL Class L 600 V ac/dc Fuses: Manufacturers: One of the following or equal:
   a. LDC by Littelfuse.
3. UL Class RK1 Fuses: Manufacturers: One of the following or equal:
   a. LLN-RK/LLS-R by Littelfuse.

b. LPN-RK/LPS-RK by Bussmann.

4. UL Class RK5 Fuses: Manufacturers: One of the following or equal:
   a. FLNR/FLSR by Littelfuse.
   b. FRN-R/FRS-R by Bussmann.
5. UL Class J Fuses: Manufacturers: One of the following or equal:
   a. JTD by Littelfuse.
   b. LPJ by Bussmann.
6. UL Class T Fuses: Manufacturers: One of the following or equal:
   a. JLLN/JLLS by Littelfuse.
   b. JJN/JJS by Bussmann.
7. UL Class CC Fuses: Manufacturers: One of the following or equal:
   a. CCMR/KLDR by Littelfuse.
   b. FNQ-R by Bussmann.
8. Fuses for Fluorescent Ballasts: Manufacturers: One of the following or equal:
   a. LGR by Littelfuse.
   b. GLR by Bussmann.
9. Fuse-Holders for Fluorescent Ballasts: Manufacturers: One of the following or equal:
   a. LHR by Littelfuse.
   b. HLR by Bussmann.
10. Fuse-Holders for HID Fixtures: Manufacturers: One of the following or equal:
   a. 5710CC/5710CCP by Littelfuse.
   b. HPF-RR by Bussmann.

2.02 GENERAL

A. Provide fuses 600 volt and below as indicated on the Drawings and as specified.

B. Fuses shall have a minimum interrupting rating of 200,000 amperes.

C. Completely install, connect, and test for insulation integrity distribution, conversion, or utilization equipment requiring fuses, prior to installation of fuses.

D. Provide fuses bolted in place with "Belleville" washers between each bolt head or nut, or fuse blade.

E. Affix a label indicating recommended torque for fuse mounting bolts or studs to the inside of fuse access doors.

F. Provide durable, readily visible label inside each fuse enclosure, clearly indicating the correct type and size of replacement fuse. Label shall not cover or interfere with equipment manufacturer's instructions.

G. Provide UL Class and type fuses as indicated on the Drawings and as specified. The specifications are non-proprietary, but not generic. Fuse classes shall conform to the detailed requirements of these Specifications.

H. To Assure Selective Coordination of Protective Devices:
1. Provide fuses for new facilities by the same manufacturer.
2. Provide fuses for renovations of the same manufacturer as existing fuses. When modifying or expanding existing facilities, remove existing one-time and renewable cartridge fuses with 10,000 ampere interrupting ratings and replace with dual-

element RK5 fuses as specified.

2.03 FUSING OF CONTROL CIRCUITS

A. Utilize UL listed branch-circuit fuses for required control circuit protection. Provide RK1 fuses as specified, or time-delay Class CC fuses installed in UL listed Class CC fuse blocks.

B. Provide minimum protection for control circuits in accordance with the latest revision of UL Standard 508 for Industrial Control.

C. Control Power Transformers: Fuse primary circuit of control power transformers. Provide fuse ratings in accordance with NEC requirements. Provide RK1 fuses or time-delay UL listed Class CC fuses installed in UL listed Class CC fuse blocks.

2.04 FUSING FOR FLUORESCENT AND H.I.D. LIGHTING FIXTURE BALLASTS

A. Individually fuse 300 volts and below fluorescent fixture ballasts. Electronic ballasts containing both internal fusing and Class P thermal protection are not required to have external fusing.

B. Fuse other ballasts in accordance with fixture or ballast manufacturer's recommendations. Mount fuse-holders in ballast wiring channel. Fuse-holders and fuses may be Littelfuse LHR with LGR fuses or Bussmann HLR with GLR fuses.

C. Individually fuse HID lighting fixture ballasts and discharge lighting fixtures over 300 volts with fuses rated in accordance with fixture manufacturer's recommendations.

D. Locate fuse-holders on ballast or fixture housing, accessible from outside of fixture. Provide UL Class CC fuses.

2.05 FUSES FOR METERING CENTERS, LOAD CENTERS, AND FOR BACKUP PROTECTION OF CIRCUIT BREAKERS

A. Provide RK1, Class J or Class L fuses as specified, or UL listed Class T fuses.

B. Littelfuse JLLN and JLLS Series, or Bussmann JJN and JJS Series. Fuse ampere ratings shall not exceed maximum recommended by equipment manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Evenly torque mounting bolts and nuts to ASTM recommendations for type and diameter of mounting bolts or studs provided. Affix a label to the inside of fuse access doors indicating recommended torque for fuse mounting bolts or studs.

3.02 INITIAL START-UP AND SPARE FUSES

A. Replace fuses opened during start-up and testing. At Contract completion, each fuse-holder shall contain serviceable fuses as specified.

B. After completion of testing, deliver spare fuses in quantities specified. Fuses shall be new, in manufacturer's original packaging, and stored in a clean, dry location.

3.03 DEMONSTRATION

A. Demonstrate equipment in accordance with Articles 2.02, 2.08, 3.01, and 3.02.

3.04 PROTECTION

A. Protect products until acceptance by OWNER.

END OF SECTION

SECTION 16416 TRANSIENT VOLTAGE SURGE SUPPRESSORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Transient voltage surge suppressors (TVSS) for use on 480 and 208 volt, alternating current systems, including motor control center mounted applications, and power distribution switchboard and control panel applications.

1.02 REFERENCES

A. Underwriters' Laboratories, Inc. (UL):

1. 1449 - High Performance Suppression System.
2. 1283 - High Frequency Extended Range Power Filter.

B. American National Standards Institute (ANSI):

1. C62.41 - Category C3 (Service Entrance).
2. C62.45 - Category C Surge.

1.03 SUBMITTALS

A. Shop Drawings: Include component layout and wiring terminations.

B. Product data.

C. Manufacturer's installation instructions.

D. Operating and maintenance data.

E. Warranties.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of transient voltage surge suppressor systems for minimum 5 years with satisfactory performance record.

B. Regulatory Requirements: UL rating of Transient voltage surge suppressor shall meet or exceed UL rating of panelboard, motor control center, or other equipment in which suppressor is installed. UL rating of equipment in which suppressor is installed shall not be affected by suppressor.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate with and furnish suppressors to motor control center, switchgear switchboard, and distribution panel manufacturer prior to shipment of equipment to site.

PART 2 PRODUCTS

2.01 TRANSIENT VOLTAGE SURGE SUPPRESSORS

A. Ratings: 277/480 volt grounded wye and 120/208 volt grounded wye.

B. Manufacturers: One of the following or equal:

1. Current Technology, TransGuard Model for motor control center installation or Series TG300 for external mounting.
2. Transtector, equivalent product.
3. Advanced Protection Technologies, equivalent product.
4. If furnished integral with MCC, switchboard or panelboard, the manufacturer of the TVSS unit can be the same as the equipment in which it is installed.

C. Components:

1. 30 ampere circuit breaker and disconnect
2. Status indicating pilot lights.
3. Two dry contacts for remote status annunciation.
4. NEMA 12 enclosure or stab-in housing compatible with motor control center or mounted integral in distribution panel.

D. Characteristics:

1. Single Pulse Surge Current Capacity per Phase: 600,000 amperes.
2. Capacity Per Protection Modes:
   a. L-N Mode: 300,000 amperes.
   b. L-G Mode: 300,000 amperes.
   c. N-G Mode: 300,000 amperes.
   d. L-L Mode: 300,000 amperes.
3. 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.
4. Suppression and Filter Technology: Manufacturer's standard.
5. Continuous Operating Voltage: Minimum 115 percent of nominal.
6. Suppression Voltage In Protective Modes: As follows when tested in accordance with UL 1449:
   a. For 480 volt systems:
      1) L-N: 800.
      2) L-G: 800.
      3) N-G: 800.
      4) L-L: 2000.
   b. For 208 volt systems:
      1) L-N: 500.
      2) L-G: 500.
      3) N-G: 400.

7. EMI/RFI High Frequency Noise Power Filter:

Frequency	100 KHz	1 MHz	10 MHz	100 MHz
Attenuation (dB)	34	51	54	48
Attenuation Ratio	50:1	350:1	500:1	250:1

8. Minimum American Wire Gauge Copper in Surge or Noise Suppression Path: Number 6.
9. Field Replaceable Fusing: Current limiting, protecting each pole.

PART 3 EXECUTION

3.01 INSTALLATION

D. Install suppressors in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 16422 MOTOR CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Manual starters, magnetic contactors, overload relays, combination starters and related motor controllers.

1.02 REFERENCES

A. National Electrical Code (NEC):

1. Article 430 - Motors, Motor Circuits and Controllers.

B. National Electrical Manufacturers Association (NEMA).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manual Motor Starters: One of the following:

1. Cutler Hammer
2. General Electric
3. Schneider / Square D Company.
4. Siemens

B. Full Voltage Magnetic Starters: One of the following:

1. Cutler Hammer
2. General Electric
3. Siemens
4. Schneider / Square D Company.

2.02 STARTERS

A. Suitable for the horsepower ratings specified, and in accordance with NEC Article 430.

B. Verify motor ratings and coordinate starter and overload trip ratings with actual horsepower and nameplate current ratings of motors installed.

C. Magnetic Contactors: Factory adjusted and chatter free.

D. Overload Relays: Install bimetallic type overload relays in each line conductor as indicated on the Drawings. Provide contacts for remote monitoring of overload status as indicated on the Drawings.

E. Mount extended overload reset buttons to be accessible for operation without opening door of enclosure. Plastic overload relay reset buttons with plastic operator shafts are unacceptable.

F. Provide starters Size 2 and larger with arc quenchers on load breaking contacts.

G. Minimum Size Starter: NEMA Size 1, and not smaller than size indicated on the Drawings.

H. Provide starters of sufficient size to accommodate motors furnished, including larger starters required for larger motors supplied by CONTRACTOR.

I. Combination Starters: Furnish complete with a 120 volt control transformer unless otherwise noted.

J. Control Fuses: Size and furnish as required and where indicated in the schematics.

2.03 MANUAL MOTOR STARTERS

A. Across-the-line manual motor starters for motors up to 1 horsepower, 600 volts shall have the electrical characteristics indicated on the Drawings.

B. Provide single-pole or 3 pole as indicated on the Drawings with overload devices.

C. Provide handles that clearly indicate the ON, OFF with lockout, and TRIPPED positions, pilot light, and positive, quick-make, quick-break mechanisms.

D. Provide enclosures as indicated on the Drawings. Where not indicated, provide NEMA 12 enclosures for indoor location and NEMA 4X enclosures for outdoor locations. Provide enclosures compatible with type of conduit system being used for each specific application.

2.04 FULL VOLTAGE MAGNETIC STARTERS

A. Across-the-line full voltage magnetic starters for up to 600 volts shall have electrical characteristics indicated on the Drawings.

B. Provide positive, quick-make, quick-break mechanisms; padlockable enclosure doors; 3 overload relays with plus or minus 15 percent adjustment from nominal heater rating on the overload relay; cover mounted reset button, and at least 3 reversible contacts in addition to hold-in contact.

C. Provide magnetic starter enclosures as indicated on the Drawings. Where not indicated, provide NEMA 12 enclosures for indoor locations and NEMA 4X enclosures for outdoor locations. Provide enclosures compatible with type of conduit being used for each specific application.

D. Provide magnetic starters in accordance with latest NEMA Standards.

PART 3 EXECUTION

3.01 APPLICATION

A. Supply circuit breaker trip elements and starter overload trip elements to meet above normal ambient temperatures where such conditions are anticipated (subject to ENGINEER's acceptance).

3.02 DEMONSTRATION

A. Demonstrate operation of equipment and provide training of Owner Operations and Maintenance Personnel

3.03 PROTECTION

A. Protect products until acceptance by OWNER.

END OF SECTION

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SECTION 16500 LIGHTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Lighting fixtures, lamps, ballasts, and accessories for illumination of the sludge thickener structures.

1.02 REFERENCES

A. Underwriters' Laboratories, Inc. (UL):

1. UL 1029 - High-Intensity Discharge Lamp Ballasts.

1.03 SUBMITTALS

A. Product Data:

1. Applicable coefficients of utilization tables, isolux chart of illumination on a horizontal plane, beam efficiency, horizontal and vertical beam spread, beam lumens.
2. Lighting control system product data and wiring diagrams specific for each lighting control system.
3. Lighting control system operation and maintenance manuals.

B. Samples: Include finish Sample for lighting fixtures.

C. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lighting Fixtures: As noted on Lighting Fixture Schedule.

B. Lamps: One of the following or equal:

1. General Electric Company.
2. GTE Sylvania Lighting.
3. Philips Lighting Company.

C. Ballasts for Fluorescent Lamps: One of the following or equal:

1. Advance.
2. Universal.
3. GTE Sylvania Lighting.

D. Ballasts, HID Lamps: One of the following or equal:

1. Advance.
2. Holophane.
3. GTE's Sylvania Lighting.

E. Plugs and Receptacles: As specified in Section 16140.

2.02 FIXTURES

A. Lighting Fixtures: As described in Lighting Fixture Schedule, as specified, and as indicated on the Drawings.

1. Fixtures shall include lamps, ballasts, poles, mounting hardware, and appurtenances to provide complete operating units.

B. Fluorescent Lamps:

1. Rapid start type.
2. T8 type, 32W; 2900 lumens.

2.03 BALLASTS

A. General:

1. Energy saving type suitable for use with energy saving lamps.
2. High power factor type, with power factor not less than 90 percent.
3. Cold weather (low temperature) rated for outdoor use.
4. Internally fused ballast.

B. Ballasts for Fluorescent Lamps:

1. Bear CBM and ETL labels certifying that ballasts meet pertinent requirements.
   a. Electronic ballasts for T8 32W.
   b. Energy saving ballasts for T12 40W lamps.
2. Contain a built-in thermal protector to disconnect ballast permanently prior to failure, or be fused.
3. High efficiency and constant wattage type.
4. Of 2 windings where required by applicable codes.
5. Use dimming ballasts with dimmer controlled fluorescent fixtures where indicated on the Drawings.
6. Rated for location of installation.

C. Ballasts for High Intensity Discharge Lamps:

1. Meet requirements of UL 1029.
2. The ballast for metal halide lamps shall include the igniter necessary for the lamp.
3. Copper windings.
4. Be internally fused.

2.04 LIGHTING CONTACTORS

A. Silver-cadmium-oxide, double-break contacts.

B. 20 ampere rating for lighting circuits.

C. Mechanically held.

D. Number of poles as indicated on the Drawings with a minimum of 2 poles and a maximum of 12 poles for each contactor provided.

E. Manufacturers: One of the following or equal:

1. Square D Company, Type LX.
2. ASCO, Model 917.

2.05 LIGHTING CONTROL SYSTEM

A. Provide lighting control systems as indicated on the drawings.

B. Manufacturers:

1. Douglas Lighting Controls, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Surface and Flush Mounted Fixtures: Solidly connected to a junction box.

B. Suspended Fixtures: Hung utilizing pendant mounting or stainless steel chains and hooks. Electrically connect each fixture, or row of fixtures, by a length of Type SO flexible cord, 3 conductor Number 14 American Wire Gauge minimum, with a twist-lock plug to a twist-lock receptacle mounted in an individual junction box by conduit as specified elsewhere herein.

C. Pole Mounted Fixtures: Mount on steel, aluminum, or fiberglass poles as described in Lighting Fixture Schedule and as indicated on the Drawings.

1. Ground or bond metal poles to the plant grounding system.
2. Poles shall have adequate handholes in accordance with NEC requirements.
3. Poles shall have weatherproof switches, receptacles, photo cells where indicated on the Drawings.

3.02 LIGHTING FIXTURE SCHEDULE

A. As indicated on the Drawings.

3.03 PROTECTION

A. Protect products until accepted by OWNER.

3.04 LIGHTING CONTROL SYSTEM TESTING

A. Site Test: After the system is completely installed, perform all tests recommended by the manufacturers.

END OF SECTION

SECTION 16670 LIGHTNING PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for design and provide a Lightning protection system for existing sludge thickener No. 1 structure and new sludge thickener No. 2 structure.

1. The lightning protection system shall be a conventional Faraday Multi-Point type System.

B. Related Sections:

1. Section 16010 - Requirements for Electrical Work.
2. Section 16062 - Grounding
3. Section 16133 - Conduits
4. Section 16950 – Testing

1.02 REFERENCES

A. Lightning Protection Institute (LPI):

1. LPI-175 - Standard of Practice.

B. National Electrical Code (NEC):

1. Article 250 - Grounding.

C. National Fire Protection Association (NFPA):

1. ANSI/NFPA 780 - Lightning Protection Code.

D. Underwriters Laboratories, Inc. (UL) for Faraday Multi-Point Type System:

1. UL 96 - Lightning Protection Components.
2. UL 96A - Installation Requirements for Lightning Protection Systems.

1.03 SYSTEM DESCRIPTION

A. Lightning Protection System: ANSI/NFPA 780; Class I, UL 96A; Master Labeled system(s) protecting, consisting of air terminals on roof(s), bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors.

1.04 SUBMITTALS

A. Shop Drawings:

1. Shop drawings showing layout of air terminals with the respective configuration of the zone of protection, grounding electrodes, and bonding connections to structure

and other metal objects. Include terminal, electrode, and conductor types and sizes, conductors routing, connection, termination details, applicable air terminal and other calculations.

B. Product Data: Include dimensions and materials of each component, and include indication of listing in accordance with UL 96 for the Faraday Multi-Point System.

C. Certificates:

1. Submit 2 notarized photocopies of the completed Application for UL Master Label, for the lighting protection system.
2. Submit written confirmation of having obtained UL Master Label and LPI certification for the Faraday lightning protection system.

D. Project Record Documents:

1. Project record documents in accordance with Contract Requirements
2. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.
3. Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. Manufacturers Qualifications: As indicated below. Company specializing in lightning protection equipment with minimum 5 years' experience, and member of the Lightning Protection Institute.

B. Installers Qualifications: Authorized installer of manufacturer with minimum 5 years documented experience.

1.06 SEQUENCING AND SCHEDULING

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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. One of the following or equal for the Faraday Multi-Point Lightning Protection:

1. A-C Lightning Security, Inc.
2. Lightning Master.
3. Thompson Lightning Protection, Inc.

2.02 MATERIALS

A. Components for the Faraday Multi-Point Lightning Protection System:

1. Listed in accordance with UL 96.
2. Air Terminals: Copper.
3. Grounding Rods: 3/4 " x 10' Copper-clad steel.
4. Ground Plate or Base: Copper with bolt pressure connectors and mounted with stainless steel hardware
5. Conductors: Copper 32 strands of 17 gauge minimum, class 1, 7/16" diameter for horizontal application.
6. Conductors: Copper 24 strands of 14 gauge minimum, class 1, ½" for main vertical application.
7. Connectors and Splicers: Bronze.

B. Miscellaneous Materials: Copper, of type and size recommended by the manufacturer of the lightning protection system, except that bolts, screws, and other threaded fasteners shall be stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as indicated on the shop drawings.

C. Beginning of installation means installer accepts existing conditions.

D. Protect elements surrounding work of this Section from damage or disfiguration.

3.02 INSTALLATION

A. Install systems in accordance with manufacturer's instructions unless otherwise specified herein.

B. Physically connect lightning protection equipment to structural roof framing members.

C. Install the systems in accordance with UL 96A, ANSI/NFPA 780, LPI-175, NEC and as specified herein. In the event that the above standards, codes and these Specifications address an issue differently, apply the most stringent requirement.

D. Install equipment in a neat manner.

E. Install the system(s) with complete network including air terminals, roof area system, connections, bonds with downleads routed down the buildings and structures and terminating into proper grounding.

F. Install main downleads concealed unless otherwise specified by the ENGINEER. Other than for the purpose of protecting downlead conductors from damage up to 6 feet above grade level.

G. 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.

H. Do not use lightning protection rods and electrodes in lieu of the grounding electrodes for electrical equipment.

I. Furnish and install lightning surge arrestors and protectors as required in coordination with other electrical equipment/work.

J. Extend air terminals a minimum of 12 inches above object to be protected.

K. Maintain horizontal or downward coursing of main conductor and insure 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.

L. Install ground electrodes not less than 1 foot below grade and not less than 2 feet from foundation walls.

M. Bond isolated metallic body at or below the roof subject to inductance and within 6 feet of lightning protection system conductors.

N. Assure sound common bonding and interconnections with other grounding systems.

O. Use minimum 1 inch PVC conduits or PVC-coated rigid steel conduits to protect lightning system conductors from damage.

P. Ensure that air terminals are installed to withstand calculated wind force due to 120 miles per hour winds with a 1.3 gust factor without structural damage and without damage to integrity of the lightning protection system.

3.03 FIELD QUALITY CONTROL

A. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and certification of the lightning protection system(s) under provisions of UL 96A.

B. Obtain UL Master Label and attach to each building at location directed by OWNER.

3.04 PROTECTION

A. Protect products until acceptance by OWNER.

END OF SECTION

SECTION 16950 ELECTRICAL TESTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Required Acceptance Testing of electrical system, wiring, equipment, and grounding.

1.02 REFERENCES

A. National Electrical Testing Association (NETA):

1. ATS-2009: Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.

B. ANSI: Test Procedures for Electrical Equipment.

C. ASTM: American Society for Testing and Materials.

D. ANSI/IEEE: Recommended Practices for Testing: Machinery, Ground Impedance, Cables and Terminations.

1.03 SUBMITTALS

A. Pre-Test Submittals:

1. Equipment testing schedule.
2. Test data forms, custom edited for difference types of electrical equipment.

B. Post-Test Submittals: Summary Test Report consists of the following:

1. Summary of testing for the project.
2. Description of the equipment tested.
3. Description of the test and test procedures.
4. Test results for each apparatus and motorized equipment.
5. Conclusions and recommendations.
6. Completed test forms, including witness's signatures.
7. List of test equipment and calibration documents.
8. Date and time.
9. A copy of this specification section with each paragraph check marked indicating compliance or marked with explicit deviations.

C. Submit Equipment Testing Schedule no later than 7 days prior to scheduled date of testing.

D. Project Record Documents: Note or indicate wiring deviations from Contract Documents on Project Record Documents.

1.04 QUALITY ASSURANCE

1. Prequalified Testing Services:

    a. Provide the services of certified electricians to perform testing of conductor insulation.
    b. Provide adequate test instruments for testing of conductors insulation.
    c. Submit certification data and experience of personnel for required testing.
2. Testing service or testing personnel may be accepted or rejected based upon, but not limited to, the testing equipment intended to be used, the qualifications of the firm, and personnel.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 SAFETY AND PRECAUTIONS

A. Testing firm shall perform tests following a safe practice in accordance with OSHA and accident prevention procedures by National Safety Council and applicable codes.

B. Tests shall be performed with apparatus de-energized, except as necessary for equipment performance and functional test.

3.02 EXAMINATION

A. Verify that electrical work is free from improper grounds, short circuits, and overloads.

B. Verify correctness of wiring first by visual comparison of the conductor connections with connection diagrams.

C. Make individual circuit continuity checks by using electrical circuit testers.

D. Verify correctness of wiring by actual electrical operation of electrical and mechanical devices in both manual and automatic modes of operation.

3.03 VERIFICATION OF EQUIPMENT RATINGS

A. Prior to perform acceptance testing, the testing personnel shall inspect and verify adequate short circuit rating of electrical equipment.

3.04 ACCEPTANCE TESTING

A. General Requirements:

1. Perform testing and allow OWNER and ENGINEER to witness testing.

2. Perform tests to assure that electrical equipment will operate within industry and manufacturer's published tolerances, and will perform safely. Record test result data, to be used as a baseline for future tests.
3. Test motorized equipment to verify conformance with the Contract Documents and for acceptance.
4. Equipment for which acceptable test data has not been submitted, or has been submitted but rejected, shall be deemed as not meeting Contract requirements.

B. Equipment and Materials Inspection and Test Procedures. Complete test reports for each individual piece of equipment and systems:

1. Motor Starters: Low Voltage:
    a. Visual and Mechanical Inspection:
    1) Compare equipment nameplate and data with drawings and specifications.
    2) Inspect physical and mechanical condition.
    3) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.
    b. Electrical Tests:
    1) Insulation Tests:
        a) Measure insulation-resistance of each combination starter, phase-to-phase and phase-to-ground, with the starter contacts closed and the protective device open.
        b) Test the motor overload relay elements by injecting primary current through the overload circuit and monitoring trip time of the overload element.
    c. Test Values:
    1) Bolt-torque levels shall be in accordance with data specified by manufacturer.
    2) Insulation-resistance values.
    3) Overload trip times shall be in accordance with manufacturer’s published data.
2. Rotating Machinery: AC Motors:
    a. Visual and Mechanical Inspection:
    1) Compare equipment nameplate and data with Drawings and Specifications.
    2) Inspect physical and mechanical condition.
    3) Inspect for correct anchorage, mounting, grounding, connection, and lubrication.
    4) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.
    5) When applicable, perform special tests such as air gap spacing and pedestal alignment.
    6) Verify the absence of unusual mechanical or electrical noise or signs of overheating during initial test run.
    b. Electrical Tests: Induction Motors:
    1) Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43.
        a) Motors larger than 200 horsepower: Test duration shall be for ten minutes. Calculate polarization index.

b) Motors 200 horsepower and less: Test duration shall be for one minute. Calculate the dielectric-absorption ratio.

2) Test motor starter in accordance with Section 7.16 of these specifications.
3) Verify that resistance temperature detector (RTD) circuits conform to drawings. Verify that metering or relaying devices using the RTD's have the correct rating.
4) Verify that the motor space heater is functional.
5) Perform a rotation test to insure correct shaft direction.
6) Measure running current and evaluate relative to load conditions and nameplate full-load amperes.

3. Low-Voltage Surge Protection Devices (TVSS):
   a. Visual and Mechanical Inspection:
      1) Compare equipment nameplate and data with drawings and specifications.
      2) Inspect physical and mechanical condition.
      3) Inspect for correct mounting and adequate clearances.
      4) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
      5) Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.
4. Grounding Systems:
   a. Visual and Mechanical Inspection
      1) Verify ground system is in compliance with drawings and specifications.
   b. Electrical Tests:
      1) Perform fall-of-potential test or alternative in accordance with IEEE Standard 81-1991 on the main grounding electrode or system.
      2) Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
   c. Test Values:
      1) The resistance between the main grounding electrode and ground should be no greater than five ohms for commercial or industrial systems and one ohm or less for generating grounds unless otherwise specified.
      2) Investigate point-to-point resistance values which exceed 0.5 ohm.
5. Low-Voltage Cables: 600 Volt:
   a. Visual and Mechanical Inspection:
      1) Compare cable data with drawings and specifications.
      2) Inspect exposed sections of cables for physical damage and correct connection in accordance with single-line diagram.
      3) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
      4) Inspect compression-applied connectors for correct cable match and indentation.
      5) Verify cable color coding with applicable engineer's specifications and National Electrical Code standards.
         b. Electrical Tests:
         c. Perform an insulation resistance test on all cables.

6. Lighting System Controllers:
   a. Perform lighting system controller function tests upon completion of equipments, to prove correct interaction of switches, controllers, and photocells.

3.05 SUMMARY TEST REPORT

A. Upon completion of testing of all electrical equipment, submit summary test report.

END OF SECTION

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SECTION 16951 ELECTRICAL FUNCTIONAL TESTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Electrical equipment and system testing requirements for the complete facility, including the following:

1. Testing Plans.
2. Operational Testing.

1.02 SUBMITTALS - START-UP PLAN

A. Provide functional testing plans and procedures for all project equipment and systems and for all modes of operation. Functional testing procedures shall be in the cause and effect format. The person conducting the operating test shall initiate an action (cause) and, upon the systems or subsystems producing the required result (effect), the specific test requirement will have been satisfied. A sample form illustrating this concept and which shows the level of detail required in the CONTRACTOR-developed functional testing form is appended to the end of this Section. Only computer-generated functional testing forms shall be submitted; handwritten forms are unacceptable.

1.03 GENERAL TESTING PROCEDURES

A. Electrical Systems: As specified in Section 16950, Section 17010, and the individual equipment specification sections.

1. Electrical testing shall be performed in two stages. The first stage shall consist of electrical equipment testing prior to energization and operation of electrical equipment. The following shall be submitted for OWNER and ENGINEER review prior to equipment startup and energization:
   a. The following completed electrical equipment testing data forms required by Section 16950.
      1) Low-Voltage Cables.
      2) Grounding Systems.
      3) Rotating Machinery: AC Motors.

   Unsatisfactory equipment test results shall require that the equipment be repaired and re-tested until acceptable results are obtained at no additional cost to the OWNER.
2. The second stage of testing shall involve the completion of functional testing forms which include all possible operating scenarios, alarm conditions, prohibitive interlocks, and indication functions. A sample form showing the level of detail required in the CONTRACTOR-developed functional testing form is appended to the end of this Section. Contractor shall perform a “dry run” for all functional tests to ensure that systems are working properly prior to witnessing by the OWNER. After the “dry run” is successfully completed, CONTRACTOR shall provide minimum 48 hours’ notice to the OWNER that systems are ready for witnessed functional testing. The OWNER will witness functional testing and will initial all functional testing forms upon successful operation of systems.

B. Instrumentation Systems: As specified in Section 17010 and the individual equipment specification sections:

1. Requirements for field calibration, loop acceptance, and end-to-end acceptance testing are specified in Section 17010.
2. Field calibration, loop acceptance, and end-to-end acceptance testing shall not begin until design submittals required by Section 17010 and CONTRACTOR-prepared drawings required by Section 16075 have been reviewed by the ENGINEER and returned marked as “No Exceptions Noted”.
3. General:
    a. Bench or field calibrate instruments and make required adjustments and control point settings.
    b. Energize transmitting and control signal systems, verify proper operation, ranges, and settings.

1.04 FUNCTIONAL TESTING

A. Functional testing shall not begin until Stages 1 has been completed for individual systems or pieces of equipment.

B. The CONTRACTOR is responsible for functional testing for all project equipment and systems in all modes of operation. This includes remote SCADA modes of operation where the OWNER does software programming and configuration. The OWNER will assist in developing functional procedures only for those testing steps involving operational testing of a remote SCADA functional mode of operation programmed and/or configured by the OWNER. Verifying the required functional testing result for these modes of operation will be a joint effort between the CONTRACTOR and the OWNER. OWNER verification responsibility will only include those required results involving a control action, status, or alarm indication at the remote SCADA.

C. Functional testing plan shall list the personnel who will be present to assist with and witness the functional test. This list shall include any CONTRACTOR personnel, subcontractors, manufacturer’s representatives, OWNER staff, ENGINEER, and any other required personnel.

D. Functionally test mechanical and electrical equipment for proper operation after general start-up and testing tasks have been completed for individual systems or pieces of equipment. Functional test of mechanical and electrical equipment required for operation of the plant shall be completed prior to performing the operational test of the entire facility.

E. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration over the full operating range of equipment and systems. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

F. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

G. Conduct continuous 8 hour test under full load conditions. If any equipment or system fails the functional test, the CONTRACTOR shall correct the problem and shall repeat the test until it is successful.

1.05 RECORD KEEPING

A. Maintain and submit following records generated during functional testing:

1. Daily logs of equipment testing identifying all tests conducted and outcome.
2. Data sheets of testing.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SAMPLE FUNCTIONAL TESTING FORM

PROCESS SYSTEM:

PROCESS AREA:
P&ID:
SCHEM DIAG NO.:

EQUIPMENT:

Testing Step	Mode Set-up	Operational Test	Required Result

All Operational Tests Successfully Completed:

Contractor's Initials: _____ Date: _____

Engineer's Initials: _____ Date: _____

END OF SECTION

SECTION 16995 RACEWAY AND WIRING SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. A list of the majority of raceways and conductors to be provided, but it does not list all raceways and conductors necessary for all complete working systems. See additional requirements on the Drawings.

1.02 GENERAL PERFORMANCE REQUIREMENTS

A. Additional Design Requirements:

1. Provide design services to supplement the attached raceways and wiring schedule with additional field engineering, to design, edit and include all raceways and wiring from different miscellaneous equipment into a complete raceways and wiring schedule.

B. Additional Raceways and Wiring Schedule Requirements:

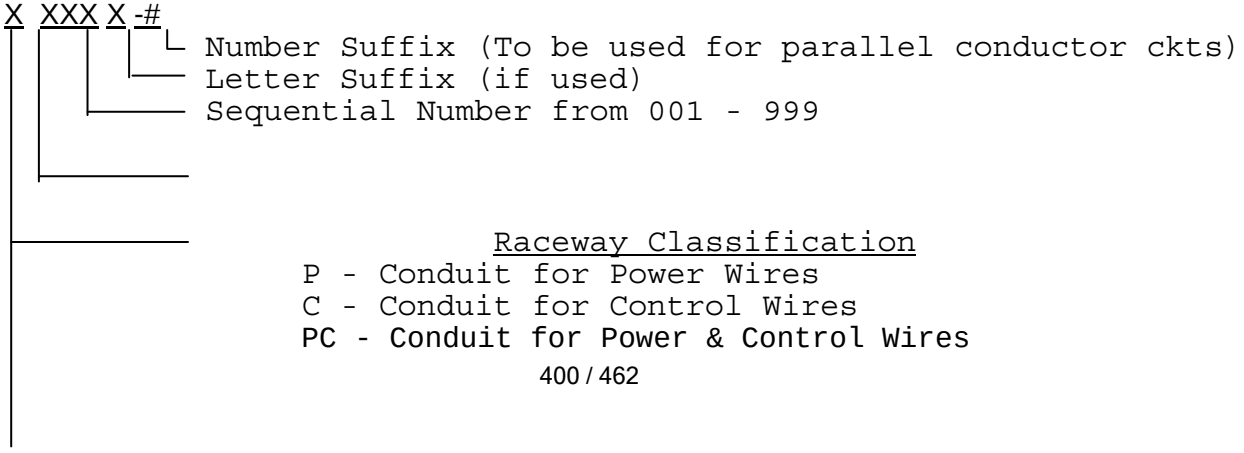
1. Provide a supplemental raceway and wiring schedule from any additional requirements of equipment manufacturers or from other divisions of work. The format of the supplemental schedule shall follow the format and text font of the attached schedule. The supplemental schedule shall be created using Microsoft Excel spreadsheet and it shall be submitted as part of as-built documents.

1.03 CONDUCTORS SCHEDULED AND DESCRIPTION

A. The conductors columns in the schedule do not distinguish requirements between insulation, single conductors and/or multiconductor cables. Nevertheless, the type of conductor shall be properly provided to comply with the adequate material and application specified in Sections 16123.

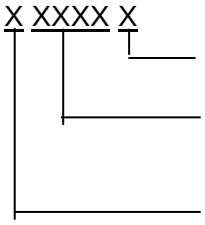
1.04 RACEWAYS AND WIRING SYSTEM NUMBERING

A. Raceway Numbering: Each raceway shall be identified by a unique number. The number shall be derived as follows:



S - Conduit for Signal Wires (Instrumentation)
PE, DHE, SE, CE, etc. - Spare Conduit
T - Telephone Conductors
F - Fire Alarm System
DH - Data Highway
DHS - Data Highway Security System (also used "S")
TP - Temporary Power Conductors

B. Circuit Numbering: Each circuit shall be identified by a unique number and cable/conductors in the circuit shall be marked accordingly. The number shall be derived as follows:



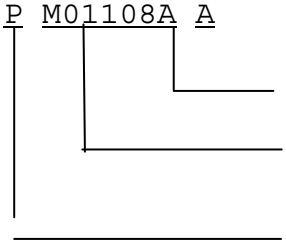
X XXXX X

Unique Cable/Conductor Identifier

Equipment Number (number of characters determined by the equipment number)

Cable/Conductor Classification
P - Power Conductors
C - Control Conductors
PC - Power & Control Conductors
S - Signal Conductors
T - Telephone Conductors
F - Fire Alarm System
DH - Data Highway
DHS - Data Highway Security
TP - Temporary Power Conductors

Example: P M01108A A



Cable A

Equipment No. M01108A

Power Conductors

1.05 SUBMITTALS

A. As-built documents with revisions plus field additions to Raceways and Wiring Schedules.

B. Submit copy of the schedule pages pertinent to conductors with field performance and acceptance test.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 VERIFICATION FOR ADEQUACY OF RACEWAYS AND WIRING

A. Prior to raceway installation, verify that size and type of raceways scheduled are adequate for the application and conductors to be installed and for electrical equipment to be connected.

B. Prior to conductors installation, verify that size and type of conductors scheduled are adequate for the application.

C. Conduits and wiring for lighting fixtures, receptacles, and HVAC systems are not included on raceway schedule. Conduits and wiring for security system panels to individual security devices are not included on raceway schedule. However, Contractor shall provide all necessary raceways and wiring in accordance with NEC and requirements indicated on the drawings for a complete working system.

3.02 INSTALLATION

A. Field Quality Control and Record Keeping
1. Correct conduit and wiring identification discrepancy which become evident during construction.
2. Perform operational testing as specified in section 16950.
3. Verify adequate termination of all conductors.

3.03 RACEWAY AND WIRING SCHEDULES

A. Not all raceway schedules are in numerical order.

B. See raceway and wiring schedule on the drawings

END OF SECTION

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SECTION 17010 BASIC CONTROLS, INSTRUMENTATION, MATERIALS & METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. This Section includes general design, material, equipment fabrication, installation, calibration, testing, commissioning, training and documentation requirements for instrumentation and control systems associated with the sludge thickener No.2, new polymer skids, sludge feed pump No. 5 and thickened sludge discharge pump No. 8, as well with their interconnection with the existing SCADA network.
2. Additional or more stringent requirements shall prevail, when pertinent and specified with process equipment in Section 11230, Section 11235 and Section 11240.

B. Work by Others:

1. Manatee County (Owner) will provide under separate contract, all software additions and modifications to existing SCADA computers at the SEWRF command center and software control logic additions to existing PLC in SCADA panel “SP-3”, located at the Thickener and Blower building No. 3, as needed for processing the additional software points.

1.02 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI B16.5 - Pipe Flanges and Flanged Fittings.

B. American National Standards Institute/ American Petroleum Institute (ANSI/API):

1. API RP550 - Manual on Installation of Refinery Instruments and Control Systems.
2. ANSI/API 551-1992 - Process Measurement Instrumentation.

C. American Society of Testing and Materials (ASTM):

1. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

D. Instrumentation, Systems, and Automation Society (ISA):

1. ISA S5.1 - Instrumentation Symbols and Identification.
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 S5.5 - Graphic Symbols for Process Displays.
5. ISA RP7.1 - Pneumatic Control Circuit Pressure Test.
6. ISA S7.3 - Quality Standard for Instrument Air.

7. ISA S12.4 - Instrument Purging for Reduction of Hazardous Area Classification.
8. ISA S18.1 - Annunciator Sequences and Specifications.
9. ISA S20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.
10. ISA S51.1 - Process Instrumentation Terminology.
11. ISA RP60.3 - Human Engineering for Control Centers.
12. ISA S71.04 - Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants.

E. Milspec:

1. MIL-I-46058C - Electrical Insulating Compound.

F. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 - Enclosures for Electrical Equipment (1,000 volts maximum).

G. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electric Code (NEC).
2. NFPA 496 - Purged and Pressurized Enclosures for Electrical Equipment.
3. NFPA 820 - Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

H. Underwriters' Laboratories, Inc. (UL):

1. UL 508 - Industrial Control Equipment.

1.03 DEFINITIONS

A. Where a term is used relating to instrumentation, and the meaning is not defined therein or elsewhere in the Contract Documents, the meaning of the term shall be as defined in ISA S51.1 Process Instrumentation Terminology, or if not contained in ISA 51.1, as defined in listed reference standards under "References".

B. Control Circuit: Any circuit operating at 80 volts AC or DC or more, whose principal purpose is the conveyance of information and not the conveyance of energy for the operation of an electrically powered device.

C. Panel: An instrument support system which may be either a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems. Unless otherwise specified or clearly indicated by the context, the term "panel" in these Contract Documents shall be interpreted as a general term, which includes flat panels, enclosures, cabinets and consoles.

D. Power Circuit: Any circuit operating at 80 volts (AC or DC) or more, whose principal purpose is the conveyance of energy for the operation of an electrically powered device.

E. SCADA: Supervisory Control and Data Acquisition.

F. Signal Circuit: Any circuit operating at less than 80 volts AC or DC.

G. Two-Wire Transmitter: A transmitter which derives its operating power supply from the signal transmission circuit and therefore requires no separate power supply connections. As used in this Specification, two-wire transmitter refers to a transmitter, which provides a 4 to 20 milliampere current regulation of signal in a series circuit with an external 24 volt direct current driving potential and a maximum external circuit resistance of 600 ohms.

H. WAN: Wide Area Network.

1.04 INSTRUMENTATION AND CONTROL SYSTEM DESCRIPTION

A. Existing System:

1. The existing SCADA network consists of SCADA panels located in process areas throughout the plant, interconnected with the SCADA command center via an Ethernet protocol.
2. The SCADA panel “SP3” is located in the blower / MCC electrical room No. 3, and includes the programmable logic controller (PLC) communication modules for interconnection of existing sludge thickener No. 1, as well includes the input and output modules with spare points reserved for the connection of additional sludge feed pump No. 5, thickened sludge pump No. 8.
3. Contractor and Instrumentation and Controls Subcontractor are strongly encouraged to visit the existing site prior to bidding, to have more understanding of the existing plant SCADA system.
4. All the detailed interface requirements may or may not be stated all in this specification. The site visit shall be carried out to obtain supplementary information for the project.
5. The existing SCADA and PLC cabinets and related hardware was originally manufactured and supplied by GE Team Controls, a Division of GE Industrial System Solutions and GE Automation Services, under their project number GEAS 161012 and a copy of the record drawings and O&M manual will be available to the Contractor.
6. The Owner has installed PLC hardware/firmware upgrades to the PLC network, for consistency with manufacturer’s available upgrades for PLC products. Details of previous upgrades will be available to the Contractor.

B. Required System Additions:

1. The SEWRF sludge thickener process will have controls and instrumentation improvements and modifications to meet this new project objective.
2. The existing PLC in cabinet SP3 shall have additional hardware/firmware as needed for processing the additional control points.

C. Additional PLC Requirements:

1. See specification section 17452

1.05 DESIGN REQUIREMENTS

A. Review other Sections and Divisions of the Contract Documents and provide full compliance with the total Contract Documents. In the event of a conflict between Sections, the CONTRACTOR shall promptly seek clarification from the ENGINEER.

B. Unless different requirements are clearly specified or shown elsewhere, instrumentation and control design, materials, equipment, installation, and testing shall comply with products and installation requirements specified in Division 16.

C. Completeness:

1. Provide a complete and fully functional instrumentation and control system ready for use.
2. Components which are not identified on the Drawings and Specifications, but necessary to meet the full functional operation and performance requirements, shall be provided.
3. Equipment shall be designed and installed in full conformity with the Drawings, Specifications, and instructions and recommendations of the related equipment manufacturer.

D. Connections and Appurtenances:

1. The instrumentation and control systems shall include all necessary connections to sources of electrical power, air, water, drains and vents, with all required valves, switches, and accessories as specified or as recommended for best operation by the manufacturer of the equipment furnished.
2. All necessary mounting panels, stands, hangers, and brackets shall be furnished and installed and shall comply with the relevant Sections of these Specifications.

E. Coordination:

1. Systems and equipment provided under this Section shall be designed and coordinated for proper operation with related equipment and materials provided under other Sections when pertinent with process equipment in Section 11230, Section 11235 and Section 11240, as well with other specifications sections of Division 17.

F. Control Functions: The complete instrumentation and control system shall perform functions as specified in Section 17411, Control Strategies.

G. Instrument Tagging:

1. All field mounted instruments shall be provided with stainless steel tags stamped or engraved with the instrument's full tag number. Tags shall be affixed with stainless steel wire fasteners.
2. All back of panel instruments shall be provided with black-white-black plastic laminate nameplates engraved with the instrument's full tag number. Nameplates shall be secured to the panel with stainless steel screws.
3. All front of panel instruments shall include the instrument's full tag number and service description in the nameplate legend. Unless it is part of the instrument, the nameplate shall be engraved black-white-black plastic laminate, secured with stainless steel screws.

H. Electrical Marking:

1. All electrical devices, terminal blocks, terminals, cables and conductors shall be clearly labeled. Terminal blocks shall have labels on both sides.

2. Cables and conductors shall be fitted with heat shrink identification sleeves. Adhesive tape identification markers shall not be used. A unique numbering system shall be provided by the CONTRACTOR, but this shall conform with requirements specified in Division 16. Cables shall be tagged at both ends and at any intermediate pull box or manhole through which the cables are routed. All cables shall be identified on the CONTRACTOR's cable schedule.

I. Cable and Conductor Termination:

1. All cables and conductors shall be terminated on terminal blocks with full identification.
2. Terminal Block Enclosures: Field mounted terminal blocks shall have NEMA 4X enclosures in wet or corrosive areas unless otherwise specified.
3. Terminal blocks, except those which are part of a manufactured unit, shall be capable of terminating 22-12 AWG wire with contact resistance no greater than 3 milli-ohms. Screws shall be captive and have metal on metal friction locking such that when wire is clamped into the metal body self-loosening is not possible. Metal components shall be manufactured from 85 percent copper alloy and be nickel-plated over 100 percent of their surface area.
4. Manufacturers:
   a. Terminal Blocks: Allen-Bradley 1492-J3 or J4. No equal.

J. Signal Transmission:

1. Unless otherwise specified, analog signal transmission between electronic (and electric) instruments not located within a common panel shall be 4 to 20 milliamperes and operate at 24 volt DC.
2. Milliampere signals shall be current regulated and not affected by changes in supply voltage and load resistance within the unit's rating.

K. Loop Impedance:

1. Total loop impedance for 4 to 20 milliamperes signals shall not exceed the rated value for the regulating device at the loop operating voltage.
2. Where necessary, loop impedance shall be reduced by providing current-to-current (I/I) isolation amplifiers for signal re-transmission.

L. Grounding:

1. Instrument panels shall be provided with a signal ground bus which shall be isolated from the power ground bus. Multiple panels in one location shall have a common point for signal ground bus connection to ground.
2. Shields and measurement loops shall be single point grounded at the source panel external terminals by bonding to the instrument panel signal ground bus.
3. Isolating amplifiers shall be provided within the panel for field equipment possessing a grounded input or output, except when the panel circuit is galvanically isolated.

M. Discrete Circuit Configuration:

1. Discrete control circuits shall be configured to fail safe, i.e., on loss of continuity or loss of power. Alarm contacts shall fail to the alarm condition which shall be open.

Control contacts shall fail to the inoperative condition unless otherwise indicated on the Drawings. Provide individual fuse for each and every loop.

N. Instrument and Loop Power:

1. Power to instruments and instrument loops shall be from sources providing the highest integrity: e.g., from the loop primary receiving instrument/module, or from a UPS when so specified. A loop shall not be dependent on a diversity of power sources, unless otherwise indicated on the Drawings. Provide individual fuse for each and every loop.

O. Field Instruments Installation Design:

1. Field instruments shall be installed in accordance with the Contract Documents, ANSI/API 550 and 551,and the manufacturer's instructions.
2. Flow conditioning devices or other required accessories shall be furnished and installed if necessary to meet the accuracy requirements in the Contract Documents.
3. Field instruments shall be mounted so that they can be easily read, can be readily approached and easily serviced, and so they do not restrict access to mechanical equipment. Field instruments not directly mounted shall be mounted on a pipe stand or local panel, unless otherwise indicated on the Drawings.
4. Field electronic instruments exposed to direct sunlight shall be provided with sun shields. LED, LCD or other digital readouts shall be oriented and shielded to eliminate exposure to direct sunlight.
5. Field instrument enclosures shall be NEMA 4X, for corrosive environments..
6. Connections from rigid conduit systems to field instruments shall be made with jacketed flexible conduit with a maximum length of 3 feet.
7. Field instruments shall be connected with cable as specified in Division 16, except when the manufacturer requires the use of special cable, or otherwise specified herein. Special cable applications shall be in accordance with the NEC.
8. Provide a power disconnect switch (NEMA 4X) for 120 VAC powered instrument which does not have a built-in power disconnect.

P. Hazardous (Classified) Areas:

1. Instrumentation and control equipment specified, is subject to the requirements for hazardous (classified) areas as specified in Division 16 and indicated on the Drawings.
2. Two-wire transmitters to be installed in a hazardous (classified) area shall be Factory Mutual approved intrinsically safe, and made safe by means of suitably rated Factory Mutual approved intrinsically safe barriers installed in a nonhazardous area.
3. Switches to be installed in a hazardous (classified) area shall be made safe by means of suitably rated Factory Mutual approved intrinsically safe barriers or intrinsically safe relays installed in a nonhazardous area.

Q. Corrosion Protection:

1. The CONTRACTOR is specifically cautioned that the treatment plant ambient air contains airborne contaminants, including but not limited to, the corrosive gases: hydrogen sulfide, chlorine and ammonia. The corrosion severity level will vary

according to specific location, temperature, relative humidity, rate of change of relative humidity, wind speed and wind direction, and may, therefore, also be subject to seasonal variation.

2. Unless otherwise specified, electronic equipment (except for modifications to existing units) shall be installed such that no significant or detrimental corrosion shall occur over a 20 year period. Installation in a NEMA 4X enclosure is acceptable.

R. Documentation to be Provided:

1. All aspects of the instrumentation and control systems design shall be fully documented, and subsequently revised to conform with the "As-Built" installation. Special care and preparation shall be taken in dealing with the modification of existing panels. For example, digital pictures shall be taken on all external incoming field wires with wire markers shown properly. Supplement with written notes in clarifying digital pictures. Dimensions shall be noted and documented. The new back panel shall be designed based upon critical dimensions on terminal strip locations and heights. Any dimensions shown on the new back panel without the existing backup information by digital pictures or notes will be rejected during the shop drawings review period.
2. This documentation shall include a fully annotated record of all application programming, e.g., for microprocessor based instruments, programmable logic controllers, SCADA computers, etc.
3. The numbering of all instruments, equipment, terminal blocks, conductors and cables shall be shown on all related documents.
4. Where an existing installation is subject to minor modifications, a comprehensive upgrade of existing documentation may satisfy the documentation requirements; however, prior acceptance by the ENGINEER shall be obtained.
5. In each and every drawing submitted, provide project number, instrument-area, and drawing number.
6. Provide as-built drawings to show interconnect with manufacturer’s equipment and contractor installed equipment. Include manufacturer’s terminal numbers, wire numbers, ad panel terminal numbers Supply manufacturer’s drawings as well as panel drawings with as-built.

S. Surge Protection:

1. Provide outdoor field instrument loops with voltage surge protection units at instruments, capable of limiting voltage to 30 volt DC peak with a response time of 5 nano-seconds, and dissipating a 15,000 watt, 1 millisecond surge. Provide 24 VDC line to line, and line to ground protection.
2. Individually fuse each 4 to 20 mA DC loop with a 1/16 ampere slow blow fuse between power supplies and receiver surge protectors.
3. Provide voltage/surge protection for 4 wire transmitters and analyzers with 120 VAC power sources. Protect both 120 VAC power source and 24 VDC signal loop.

1.06 SUBMITTALS

A. General:

1. Submittal data shall be grouped in a logical manner to facilitate review of subsystems and each submittal shall be substantially complete. Individual drawings and data sheets submitted at random intervals will not be accepted for review.
2. Incomplete submittals will be returned to the CONTRACTOR without the ENGINEER's review and without contract time extension.
3. Design Data submittals shall be reviewed and returned with resubmittal not required, before fabrication is started.
4. All panel drawings additions and loop drawings shall be produced with latest version of AutoCAD software.

B. Design Submittals:

1. Bill of Material for all equipment.
2. Instrument Data Sheets using ISA S20 format, with variations/enhancements to accommodate specific types of instruments.
3. Catalog Data for all instruments and equipment, with applicable features and options "arrowed."
4. System Configuration Diagrams.
5. Panel Arrangement Drawings for panels or enclosures showing size, arrangement, cut-outs, color, item identification, nameplate legends, and annunciator engravings.
6. Panel Wiring/Piping Drawings.
7. Loop Diagrams for Analog and Discrete Signals, in accordance with ISA S5.4 and the Drawings: "Typical Loop Diagrams".
    a. The diagrams shall be fully detailed including all equipment and locations, new and existing, reached by the loop and its branches.
    b. The diagrams shall include instruments, electrical equipment, mechanical packaged equipment, and terminal strip, wire, and cable numbers. Loops with associated inputs and outputs shall be drawn compositely.
    c. Loop continuity via programmable control functions shall be depicted schematically using P&ID symbology.
8. Schematic Diagrams (also known as elementary diagrams, control diagrams, and logic diagrams) shall be provided for hardwired and programmable logic/control. Diagrams (including printouts) shall include full annotation of all elements, cross references, and explanation of annotation.
9. Electrical cable and wire marking (identification) system, for all analog and discrete loops.
10. All drawings and documents produced by the CONTRACTOR or Subcontractor shall reference the identical tag numbers as shown on P&IDs.
11. PLC process control logic, equipment control logic programs.
12. One list of I/O shall be submitted. Identify analog tags which are logged for reporting.

C. Installation Submittals:

1. Installation, Operation and Maintenance Manuals for proprietary instruments and systems. Upon acceptance of equipment and before installation, submit 3 sets for information only.
2. Retrofit Schedules: 30 days prior to scheduled start of retrofit.
3. Cable and Wire Schedules, including existing which are not removed under retrofit or demolition work.

D. Testing Submittals:

1. Test Plan: 60 days prior to scheduled start of testing.
2. Test Procedures: 60 days prior to scheduled start of testing.
3. Factory test data records, certified.
4. Field test data records.

E. Training Program Submittals: 60 days prior to scheduled start of training, submit training program course outline and training schedule.

1. Training Program course outline and training schedule shall be submitted with: technical or operation heading, subjects, times, duration of sessions, name of instructor. There shall be a description of each subject-session. There shall be a list of instructors with their employer's name, job title and qualifications. Be prepared to tailor the training schedule for compatibility with the plant operations staffing requirements.

F. Project Closeout Submittals:

1. Recommended Spare Parts List.
2. Operation and Maintenance Manuals for project, fully indexed, incorporating all instrumentation and control system documentation submitted and produced, and revised to conform with the "As-Built" installation. Application specific operation and maintenance instruction and application program records shall be included. Submit 1 set for review and 4 sets of the final accepted manuals.
3. Submit electronic copies of all drawings revised to conform with the "As-Built" installation for the OWNER's records after acceptance of the project Operation and Maintenance Manuals.
4. Magnetic Media, 2 sets, in the form of CD-ROM , bearing all electronically formatted documents including "As-Built" CAD drawings and application programs, shall be submitted for information only and the OWNER's records; after acceptance of Operation and Maintenance Manuals for project. The media shall contain a table of contents, ASCII formatted, identifying the contents of each file and the software program/version with which it was produced. The media shall contain a CAD plotting document providing definition of, and correlation between layers/colors and line types for all CAD files.

1.07 QUALITY ASSURANCE

A. Procurement Restriction:

1. Certain equipment manufacturers with marketing operations based on local agents, have terms where the selling agent has responsibility for after sales service. In such cases, the CONTRACTOR's procurement of such equipment is restricted to the selling agent within whose service area the equipment will be finally installed, thus assuring the OWNER of the availability of local after sales service.

B. CONTRACTOR or Subcontractor Qualifications:

1. Instrumentation and Control Systems for additions and/or wiring interconnections to existing SCADA system and SCADA panel SP-3 shall be provided under the

supervision of a local single contractor or subcontractor, which has been regularly engaged over the previous 5 years in supervision of projects of similar scope and complexity in wastewater treatment plants.

a. Local Instrumentation and Controls subcontractors shall be licensed in Florida and have a service office within 100 miles of the project site.

2. Supervision shall include responsibility for, but not be limited to design, procurement, fabrication, installation, field loop integrity, programming, calibration, testing, commissioning, training, documentation, and interfacing requirements.
3. Installation and wiring of instrumentation and controls shall be supervised by an on-site experienced Electrical Engineer or Control Systems Engineer.
4. The supervisor shall be subject to acceptance by the ENGINEER. The supervisor's resume shall be submitted showing relevant and sufficient experience. If so required, the supervisor shall attend an interview at the ENGINEER's facility. The ENGINEER's decisions shall be final.

C. Quality Assurance Procedure:

1. A quality assurance procedure shall be defined and implemented by the CONTRACTOR or subcontractor supervising instrumentation and control systems. The procedure shall:
   a. Provide quality assurance data sheets listing specific tasks and stages of tasks, with space for the printed names of the executor and checker, and the checker's signature and date.
2. The quality assurance procedure shall form part of the contractual requirements for subcontractors, and manufacturers or suppliers with unit responsibility.
3. The quality assurance data sheets shall be maintained current and shall be available for inspection upon request.

D. Unit Manufacturer or Supplier Responsibility:

1. Specific control system(s) shall be contracted or subcontracted as a whole to one manufacturer or supplier who shall have unit responsibility. This shall apply to the following system(s):
   a. The sludge gravity belt thickener No. 2 Control Panel (TCP-2) and related instruments and controls shall be provided under the scope of work of the sludge thickener Manufacturer and/or Supplier specified in section 11230. The equipment products shall comply with requirements specified in pertinent sections of Division 16, as well pertinent sections of Division 17, and its Programmable Logic Controller (PLC) shall comply with product requirements specified in Section 17452.
   b. The polymer skid unit No. 1 control panel and skid unit No.2 control panel and related instruments and controls shall be provided under the scope of work of the polymer feed system Manufacturer and/or Supplier specified in section 11235. The equipment products shall comply with requirements specified in pertinent sections of Division 16, as well pertinent sections of Division 17.
   c. The integration and/or interconnection of the sludge thickening control system and sludge pumping system with the existing SCADA system shall be provided under the scope of work of a local Instrumentation and Controls subcontractor.
2. Unit responsibility shall include, but not be limited to, design, procurement, fabrication, installation, field loop integrity, programming, calibration, testing,

commissioning, training, documentation, and interfacing requirements. This shall also include obtaining final acceptance. Final acceptance shall be dependent on a complete system, fully tested and operating in a manner satisfactory to the OWNER and the ENGINEER, and in accordance with the Contract Documents.

3. A unit manufacturer or supplier, shall have been regularly engaged over the previous 5 years in the business of providing comparable control systems with the same level of responsibility.
4. The bid proposal shall include a “Statement of Qualifications” listing dates, projects, scopes of work, and instrumentation and control contract dollar values.
5. The bid proposal shall include a “Statement of Qualifications” listing dates, projects, system size in terms of inputs/outputs (I/O), and system equipment.
6. Additional qualifications or a prequalification proposal shall be provided where required in the relevant Section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery Timing:

1. No instrumentation or control system equipment shall be delivered to the job site until required for integration with other construction, and all necessary environmental preparations have been made.

B. Intermediate Storage and Handling:

1. When the CONTRACTOR is obliged to take delivery in advance of this time, the CONTRACTOR shall do so at a bonded air-conditioned warehouse.
2. The CONTRACTOR shall provide for storage at the warehouse and transport of the equipment to the jobsite by suitably qualified movers with moving equipment (e.g., floating bed truck) as recommended by the manufacturer.

C. Non-Compliance:

1. Should the equipment be delivered to the jobsite and be stored in adverse conditions or installed in improper environmental conditions, then at the ENGINEER's discretion, prior testing may be declared void.
2. The prior testing (e.g., factory acceptance testing) shall be repeated and/or, at the discretion of the ENGINEER, a reduced value dollar credit shall be provided by the CONTRACTOR.

3. The equipment shall still be required to satisfy site testing performance criteria.

1.09 SITE CONDITIONS

A. General: Instrumentation and control systems equipment shall be suitable, or made suitable, for site conditions at the project location.

B. Temperature:

1. Electrical and Control Room Temperature: 60 to 100 degrees Fahrenheit.
2. Field Locations Temperature: 20 to 120 degrees Fahrenheit.
3. Above temperatures do not include affects of direct sunlight or wind chill.

C. Relative Humidity (RH):

1. Electrical and Control Rooms RH: 20 to 98 percent.
2. Field Locations RH: 10 to 100 percent.

D. Atmospheric Contaminants:

1. Atmospheric contaminants include hydrogen-sulfide, chlorine, ammonia and dust in indeterminate concentrations.
2. Corrosive atmosphere testing shall be conducted, where specified.

E. Hazardous Areas:

1. Hazardous areas shall be as specified in Division 16 and as shown on the electrical Drawings.

F. Electromagnetic Radiation:

1. Electromagnetic radiation: 27 to 500 MHz: 10 volts/m.

1.10 SEQUENCING AND SCHEDULING

A. General:

1. Sequence and schedule instrumentation and control system provisions and the progress schedule.
2. Coordinate instrumentation and control system delivery and installation with other portions of the Work.

B. Special Planning:

1. Retrofit of the existing plant shall be specifically scheduled and sequenced. Shutdown of existing plant shall be minimized. All shutdown operations shall be scheduled with the OWNER. Detailed planning and careful execution shall be conducted to limit risk of accidental shutdown of adjoining existing facilities.
2. The work shall be divided into stages that shall be individually scheduled with the OWNER. For each stage, a detailed retrofit schedule shall be submitted. The retrofit schedule shall list each individual action in step order, identifying individual devices, terminals and wire numbers. Prior to commencing each stage of retrofit work, and prior to shutdown the CONTRACTOR shall make a "dummy run" through the schedule to add identification markers to all unmarked devices, terminals and wires.
3. Planning of work shall include allowance for testing requirements detailed in Part 3.

PART 2 PRODUCTS

2.01 MATERIALS

A. Refer to other instrumentation and control Sections.

2.02 SOURCE QUALITY CONTROL

A. Factory Testing:

1. Instrumentation and control systems shall be factory tested and calibrated.
2. Factory test/calibration records shall be submitted to the ENGINEER to show that the equipment has achieved the specified performance and accuracy.

3. Additional Factory Testing: Refer to other instrumentation and control Sections.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install instrumentation and control systems in accordance with Drawings and Specifications, final submittals, manufacturers instructions, and (where applicable) American Petroleum Institute RP550/551.

B. Electrical: Install cable and wiring in accordance with applicable Sections in Division 16.

C. Piping: Install piping and fittings in accordance with applicable Sections of Divisions 2 and 15.

D. Field Equipment:

1. Install field equipment such that ports, terminals and adjustments have unobstructed access for in-place testing and calibration. Equipment shall not obstruct walkways. Where possible, hand controls and indicators shall be 48 to 60 inches above the floor or a permanent work platform.
2. Equipment shall be installed suitably protected from environmental conditions. Equipment shall be mounted such that shock or vibration will not impair its operation.
3. Sun Shade:
   a. Each instrument transmitter with a readout and each control panel located outdoors shall be provided with a sun shield.
   b. Sun shield shall be designed and installed to minimize heat gain in instruments and panels.
   c. Where practical, outdoor instruments shall be installed so readouts face north to minimize direct sun exposure.
   d. Design and install sun shield to prevent direct sunlight from striking instrument readouts.

3.02 FIELD QUALITY CONTROL

A. Testing - General:

1. The requirements given in this Section are a minimum and may be augmented, but not replaced, by more specific requirements in subsequent Sections.
2. 70 days before the commencement of any testing activity, the CONTRACTOR shall submit a detailed test plan; and detailed step-by-step test procedures,

complete with forms for the recording of test results, testing equipment used, and space for signature identification of the individual witnessing the test.

3. No required test shall be applied without prior notice to the OWNER. Testing shall not be conducted without being witnessed unless with the prior acceptance of the OWNER or OWNER's representative.
4. Each unit of test equipment used shall have a certified calibration report traceable to the National Institute of Standards and Technology (NIST), and issued within 6 months of the testing date. These calibration reports shall be submitted with the test records. Test instruments shall have an accuracy 3 times better than that of the device under test. Analog devices shall be tested at 5 equally spread points over the full range.

B. Field Calibration Testing:

1. Field test and calibrate all control systems and instrumentation in accordance with the reviewed Testing Procedure submittal and the manufacturer's instructions.
2. Field test/calibration data sheets shall be submitted to the ENGINEER to show that the equipment has achieved the specified performance and accuracy.
3. Unless identified by the CONTRACTOR as an exception in the bid, accuracy shall be within the specified tolerance. Accuracy shall be within the manufacturer's stated tolerance where this is a lesser value.
4. Field-testing shall include all discrete and analog loops.
5. Use ISA standard calibration sheets whenever available.

C. Acceptance Testing - General:

1. Conduct control system and loop acceptance tests proving control system performance, and loop integrity and accuracy, in accordance with the reviewed Testing Procedure submittal and the manufacturer's instructions.
2. Acceptance tests shall be witnessed by the ENGINEER and data sheets shall be submitted recording results and acceptance.
3. Where equipment or systems fail to meet the manufacturer's specified performance and accuracy, the CONTRACTOR shall provide the on-site services of the manufacturer's field service engineer to resolve the problem at no cost to the OWNER.

D. Loop Acceptance Testing:

1. For each and every analog and discrete circuit, verify the proper operation of all hardwired circuits, functions, and logic.
2. Test the accuracy of each hardwired loop. Overall loop accuracy shall not exceed the sum of the accuracies of the loop components as determined under Field Calibration Testing.

E. End-to-End Acceptance Tests:

1. For each and every analog and discrete circuit, perform an end-to-end test. Also test each signal circuit transmitted over digital networks (i.e., valve networks, RS-422 links, etc.).
2. Check each loop from the field element to the respective computer control display. Include all intermediate field instruments, control devices, panels, indicators and

other devices in the loop to ensure proper operation and linkage to computer control station displays.

3. Analog signals shall be tested at 0, 50, and 100 percent of scale to verify the proper receipt on computer control displays.
4. Discrete input circuits shall be tested to verify proper state when the field device is switched between state. Discrete output circuits shall be tested to verify equipment responds properly (start, stop, etc.).

F. Control Strategy Acceptance Tests:

1. For each control strategy and for each electrical schematic diagram, demonstrate the proper operation of all hardware and software logic and control functions. Perform a step by step test of each function described in each control strategy.
2. Perform separate tests on each individual piece of equipment, and for each control loop.
3. Perform the proper operation of each discrete control loop to ensure the proper operation of motors, hand switches, interlocks, solenoid valves, other auxiliary devices, status lights, computer control operator interfaces, and alarms.

3.03 TRAINING

A. General:

1. The requirements given in this Section that follow are a minimum and may be augmented, but not replaced, by more specific requirements in subsequent Sections.
   a. Provide training to the OWNER in the maintenance, programming and operation of the instrumentation and control systems. Instructors shall have in-depth knowledge and experience in the subjects they cover. Instructors on major systems, complex instruments or analyzers shall be employed or certified by the manufacturer.
   b. Each attendee shall be provided with a set of documentation covering the subject matter.
   c. One set of documentation and 1 copy of any video tapes used shall be provided to the OWNER.
   d. The OWNER shall be permitted to video tape all live training sessions.
2. The costs associated with training of the OWNER's and ENGINEER's designated staff shall be included in the Contract Price, including travel, accommodation and per diem for instructors visiting the plant and/or attendees visiting the manufacturer.

B. On-Site Training:

1. Provide on-site training for all instrumentation and control systems. On-site training shall include: testing and maintenance techniques, set-up, calibration, operation, application programming, system reconfiguration, a thorough description and explanation of the on-site control system, failure and recovery procedures (inducing failures), and operation during failures. Both theory and hands-on experience shall be provided.
2. Allow for 8 hours of operational training and 8 hours of technical training with no limitation on the number of allowable attendees.

3. Allow each training in two groups, each group separately attending the same amount of time as stated above.

3.04 CLEANING

A. Clean area during construction.

B. Vacuum panels, cabinets, and enclosures to remove dust and debris. Wipe surfaces clean.

END OF SECTION

SECTION 17127 Panel Instruments

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. anel instruments and control systems as general requirements for sludge thickener No. 2 control panel (TCP-2) specified in section 11230.
2. anel instruments and control systems as general requirements for polymer feed system, Skid unit No. 1 control panel and skid unit No. 2 specified in section 11235.

B. Related Documents: Drawings and General Provisions of the Contract, including General and Supplementary Conditions and apply to work of this Section.

1.02 SUBMITTALS

A. Shop Drawings:

1. anel elevation and device layout diagrams.
2. chematic diagrams.
3. iring diagrams.
4. oop diagrams.

B. Manufacturer's installation instructions and mounting details.

C. Factory and field calibration data sheets for instruments and devices that require set-up and calibration.

PART 2 PRODUCTS

2.01 PANEL INSTRUMENTS

A. General Requirements:

1. lectronic panel instruments shall be industrial grade instruments with a proven reliability record. Scales shall be calibrated in engineering units.
2. anel controllers and recorders shall be of a rail mounted draw-out type of depth suitable for the panel but not more than 20 inches deep. Instrument operation,

tuning, and fine adjustment shall be possible without disconnecting the instrument from the process.

3. nstruments shall have matching or compatible fascia such as height, finish, color and display color with arrangement to provide a logically grouped panel display.

4. rovide programming equipment. Where this includes the use of an IBM compatible PC, the programming software shall be provided, registered to the OWNER.

5. nalog signal indicators shall be LED bar graph or numeric displays. LED bar graph shall have an accuracy of plus or minus 0.5 percent of span. An LED bar graph duplicated by a digital display shall have an accuracy of plus or minus 1.0 percent of span. Digital displays shall have an accuracy of plus or minus 0.1 percent of span for setpoints and measured variables; and plus or minus 0.3 percent of span for retransmitted and output variables. Temperature drift shall not affect accuracy by more than an additional plus or minus 0.01 percent per degree Celsius.

6. lectronic panel instruments shall be able to operate from 120 volts AC plus or minus 10 percent, 60 Hertz, and 24 volts DC plus or minus 10 percent power supply. Instruments in the same panel shall be powered from the same power supply.

7. anel instruments shall be capable of providing loop power (nominally 24 volts DC) for all analog inputs and outputs. Signal circuits and power supply circuits shall be galvanically isolated from each other and the instrument case.

8. perating temperature range shall be from 40 degrees Fahrenheit to 120 degrees Fahrenheit and relative humidity to 90 percent noncondensing.

9. anel instrument enclosures shall be NEMA 4X, with 304 stainless steel material and painted white, unless otherwise specified.

B. Indicating Lights:

1. anufacturers: One of the following or equal:
   a. Allen-Bradley 800T-QTH10.
   b. Eaton Corporation.
   c. Cutler Hammer Products, Type T.
   d. General Electric Company, Type CR.

2. eavy-duty, oil-tight type, which utilizes a 6 VDC lamp and a built-in transformer. Engrave legends on the lens or on a legend faceplate. Lamps shall be easily replaceable from the front of the indicating light.

3. ntegrate a push-to-test feature with each indicating light, or a common test of all panel indicating lights.

C. Selector Switches:

1.
anufacturers: One of the following or equal:
a. AB 800T-N2KN4B.
b. Eaton Corporation.
c. Cutler Hammer Products, Type T.
d. General Electric Company, Type CR.
e. Allen-Bradley Company.

2.
elector Switches: Heavy duty oil-tight type with gloved-hand or wing lever operators. Engrave position legends on switch faceplate. Switches for electric circuits shall have silver butting or sliding contacts, rated 10 amperes continuous at 120 volts AC.

3.
ontact Configuration: Switches used in electronic circuits shall have contacts with a minimum rating of 2 amperes.

D. Indicating Selector Switches:

1.
anufacturers: One of the following or equal:
a. AB 800T GJR2KB7AX.

2.
ulti-light oil-tight with cover plates as indicated on the Drawings or as required for the application.

2.02 PANEL DEVICES

A. Horn:

1.
anufacturers: One of the following or equal:
a. Panalarm Division of Ametek, Inc.
b. BETA Products.

2.
urnish audible alarm device and a 24 volts DC power supply. Where indicated on the Drawings, furnish separately mounted pushbuttons, flasher unit, and a horn with adjustable volume range of 78 to 103 decibels.

B. Control Relays:

1.
anufacturers: One of the following or equal:
a. AB700-HT series for current above 6 amp and AB700-HL series for 6 amps and below.
b. Eagle Signal Controls, Series 22 or 80.
c. Manufacturers of Struthers-Dunn, Inc., Series A3 or A4.

2.
rovide control relays indicated in instrument and control panels and enclosures with plug-in socket base type with dustproof plastic enclosures.

3.

elays: Relays shall function as indicated on the Drawings, in accordance with design requirements, and with not less than 4 pole, Form "C" double-throw contacts.

4.

ontrol circuit relays shall have silver-cadmium oxide contacts rated for 10 amperes at 120 volts AC.

5.

lectronic switching-duty relays shall have gold-plated or gold alloy contacts suitable for use with low level signals.

6.

elays utilized for computer input, alarm input, or indicating light service shall have contacts rated not less than 5 amperes.

7.

ime delay relays shall have dials or switch settings engraved in seconds, with timing repeatability of plus or minus 2.0 percent of setting.

8.

rovide latching and special purpose relays as indicated for the specific application.

9.

elays shall have a built-in lamp, LED or neon, to indicate an energized relay.

C. Audible and Visual Alarm Devices (for vendor furnished LCP):

1.

anufacturers: One of the following or equal:

a. Federal Signal Corporation.

b. Edwards Company, Inc.

2.

rovide a nominal 4 inch 120 volts AC vibrating 65 decibels to 110 decibels adjustable volume industrial grade weather resistant device as required by the panel layout, schematic diagram, or 1 line diagram.

3.

rovide a nominal 5 inch diameter red flashing strobe alarm light, 200 watt, where indicated on the panel layout, schematic diagram, or 1 line diagram.

4.

ower requirements: 120 volts AC or 24 volts DC per the Drawings.

2.03 SIGNAL CONDITIONING MODULES

A. Requirements:

1.

ignal conditioning modules and converters shall be of industrial grade, high quality instruments. Modules shall be of a plug-in circuit board design. Converters shall be mounted in a common 19-inch rack with a common power supply for powering the rack.

2.

xternal power supply for the rack shall be 24 volts DC plus or minus 10 percent or 120 volts AC plus or minus 10 percent, 60 Hertz with internal power supply of 24 volts DC.

3. nalog input signals shall be 4 to 20 milliamperes DC into 50 ohms or 1 to 5 volts DC into 1 Mohm input impedance.

4. nalog output signals shall be 4 to 20 milliamperes into 0 to 600 ohms or 1 to 5 volts DC into 20 Kohm.

5. iscrete output contacts shall be double-pole double-throw rated 5A at 120 volts AC or 28 volts DC.

6. lectronic trips shall make output contacts to open in case of loss of signal or power supply.

7. pan and zero adjustments shall be made by front mounted multi-turn potentiometers.

8. lectronic trip modules shall be provided with LEDS for relay status indication.

9. ignal terminals and power supply terminals shall be galvanically isolated.

10. onverters shall be provided with radio frequency interference (RFI) traps to shunt conducted radio interference to ground.

11. onverter outputs shall be galvanically isolated from the input circuits.

12. emperature rating shall be 0 degrees Celsius to 120 degrees Celsius for specified performance.

13. ndividually mounted signal conditioning modules shall be able to operate from a 24 volts DC plus or minus 10 percent or 120 volts AC plus or minus 10 percent, 60 Hertz power supply.

14. ignal conditioning modules shall be the product of one manufacturer.

15. anufacturer shall be Action Industries, Slim Pac series to match the plant existing devices.

B. Current-to-Current Converters (for vendor furnished LCP's):

1. anufacturers:

   a. Action Industries, Slim Pac series to match.

2. olid-state or microprocessor circuitry with electrical isolation between the power supply, the input signal, and the output signal.

3. ach current-to-current converter shall be designed to accept 4 to 20 milliamperes DC analog input and produce an identical 4 to 20 milliamperes DC output signal. Input and output(s) shall be galvanically isolated. Input impedance shall be 50 ohm and output driving impedance shall be 0 to 650 ohm.

4.

ccuracy shall be within plus or minus 0.1 percent of span with temperature effect within plus or minus 0.0025 percent of span per degree Fahrenheit. Power supply effect shall not exceed plus or minus 0.05 percent of span.

2.04 POWER SUPPLIES AND CONDITIONING EQUIPMENT

A. General Requirements:

1.

olid-state electronic instrumentation loads shall be supplied with AC power which has been conditioned to suit the instrumentation manufacturer's specified requirements. Power supplies to panels housing electronic instrumentation shall include a noise isolation transformer.

2.

his provision is not necessary where the electronic instrumentation includes an integral isolation transformer or equivalent noise isolation is provided by an alternative UPS power supply conditioning device.

B. Noise Isolation Transformers:

1.

anufacturers: One of the following or equal:

a. Topaz/Square D Company.
b. Cutler-Hammer.
c. Cooper Industries.

2.

oise isolation transformers shall be of the triple box shield type. Each coil shall be completely enclosed in a grounded conductive faraday shield, and the overall transformer enclosed in a faraday shield. Common mode noise attenuation between primary and secondary shall exceed 130 decibels at up to 100 KHz. Transverse mode noise attenuation shall exceed 20 decibels at up to 100 KHz. Isolation transformer dielectric strength shall be 2,500 volts minimum.

3.

solation transformers serving panel boards and control panels shall have a load capacity not less than 200 percent of the connected load. Isolation transformers serving individual instruments shall have a load capacity not less than 125 percent of the connected load. Loss in the isolation transformer shall not exceed 2 percent of the maximum load rating.

4.

armonic distortion introduced by the isolation transformer shall not exceed 0.1 percent. Three phase units shall be 4-wire Y connected and capable of supporting 100 percent unbalanced load.

C. Direct Current Power Supplies:

1.

anufacturers: One of the following or equal:

a. Lambda Electronics, Inc.
b. Solar Power Supplier SDN 5-24-150P.

2.

irect current power supply units shall be switching type. Line regulation shall not

exceed plus or minus 0.4 percent for 95 to 132 volts AC input variation. Load regulation shall not exceed plus or minus 0.2 percent for 0 to 100 percent load variation. Ripple shall not exceed 150 millivolts peak to peak. Temperature coefficient shall not exceed 0.03 percent per degree Celsius.

3. utomatic adjustable overvoltage shutdown and overtemperature protection shall be included. An integral or external undervoltage relay shall provide an alarm on undervoltage, overvoltage, or overtemperature. Transient voltage response to a 50 percent step change in load shall not exceed 0.25 volts or plus or minus 0.1 percent after 20 milliseconds. Hold-up time shall be 16.7 milliseconds or greater. Efficiency shall be 75 percent or greater. Conducted electro-magnetic interference (EMI) shall conform to FCC Docket 20780, Class A. Radiated EMI shall be minimized with suitably designed screened enclosures.

4. 4 volt nominal power supply systems shall be of redundant configuration and shall provide 26.4 volts at the distribution terminals at no load. An allowance for voltage drop across redundant unit isolation diodes will typically necessitate the selection of 28 volt nominal power supply units with outputs adjusted to suit. The capacity of each unit shall be 50 percent greater than the maximum system connected load.

5. nternal built-in switchable from single to parallel mode without using an external diode circuitry.

D. Uninterruptible Power Supplies (UPS):

1. anufacturers: One of the following or equal:
   a. Sola.
   b. Best Power Technology, Inc.
   c. Emerson Industrial Controls.
   d. Topaz/Square D Company.

2. eneral Requirements: The UPS shall be configured as a single channel, normally on-line, with automatic bypass switching on channel failure, and with manual bypass switching for maintenance. The UPS shall include rectifier/battery charger, batteries, inverter, static transfer switch, and solid state controls and shall be pulse width modulation (PWM) technology.

3. nput Voltage: Single phase, 120 volts AC plus or minus 10 percent, without reduction in DC bus voltage; 120 volts AC minus 20 percent without drawing DC power from batteries.

4. nput Frequency: 60 Hertz.

5. utput Voltage: Single phase, 120 volts AC plus or minus 5 percent for line and load changes.

6. utput Harmonic Distortion: Not greater than 5 percent (voltage) total.

7. utput Frequency: 60 Hertz plus or minus 0.5 percent free-running; 60 Hertz plus or minus 2 percent synchronized.

8. tatic Switching Response Time: Not greater than 4 milliseconds.
9. VA Rating: Not less than 150 percent of connected load. 1 KVA.
10. VA In-Rush Rating: 1.5 x total connected load in-rush.
11. attery Capacity: 30 minutes minimum.
12. oise Emission: Not greater than 60 decibels at 1 meter.
13. atteries shall be sealed, no maintenance type, designed for 5 years minimum service.
14. n output distribution board shall have a minimum of 6 circuit breakers suitably rated for the application.
15. isplays Shall Include: On-line or bypass mode, input power failure, UPS fault, UPS overload, battery discharging, UPS input volts, UPS output volts, UPS output percent load.
16. ommon fault alarm output dry contacts (open on alarm).
17. ypass mode alarm output dry contacts (open on alarm).
18. he UPS manufacturer shall provide a 1 year 24 hour field service warranty.

2.05 MINITREND ELECTRONIC RECORDERS

A. Manufacturer shall be Honeywell. Model number shall be Honeywell EW-80661-36.

B. Technical Requirements:

1. assword protect electronic data for 21CFR Part 11 Compliance. Four levels of password protection and up to 10 different password options shall be provided.
2. p to 16 universal analog inputs enable process monitoring from multiple sensors.
3. ate integrity shall be maintained by storing data in secure files based on pen designation. Data retrieval shall be simple and easy.
4. isplay: 5-1/2-inch color LCD display.
5. rovide the operator interface, which shall provide easy access to the recorder menus for quick set up and replaying if date. A real time clock shall automatically stamp time and date of all logged data.
6. ecording: The data shall be monitored if no changes and observed the data is only logged periodically. If the data is changing rapidly, it shall be recorded normally at the programmed rate. Data compression shall be used up to 100:1.

7. ackup: A 4 MB EEPROM battery powered back up shall prevent the loss of data in the event of power interruption or loss.

8. ogging rate and display rate shall be independently programmable allowing data to be displayed and stored at the rates that best suit the application.

C. See electrical drawings and mechanical drawings for the property grouping of input signals to a recorder or more than one recorder to suit the project need. Recorder and input signal field devices shall not be longer than 550 feet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are satisfactory for installation of products.

3.02 DEMONSTRATION

A. Demonstrate operation of equipment.

3.03 PROTECTION

Protect products until acceptance by OWNER.

END OF SECTION

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SECTION 17129 MISCELLANEOUS INSTRUMENTS AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Permanently installed control system instruments not specified in other Sections.

1.02 REFERENCES

A. American National Standards Institute (ANSI):

1. C 37-90a - Relays and Relay Systems Associated with Electrical Power Apparatus.

1.03 SUBMITTALS

A. Product Data: Include factory and field data calibration data sheets for instruments requiring field set-up and calibration.

B. Shop Drawings: Include connection diagrams.

C. Manufacturer's Installation Instructions.

1.04 MAINTENANCE

A. Maintenance Service: Contract with OWNER to Provide maintenance service at mutually agreed upon terms.

PART 2 PRODUCTS

2.01 FIELD-MOUNTED DIGITAL PROCESS INDICATORS

A. Manufacturers: One of the following or equal:

1. Action Instruments, Model V460.
2. Yellow Springs Instruments, Model 4400.
3. Fischer and Porter, equivalent product.
4. Leeds and Northrup, equivalent product.

B. Features and Characteristics:

1. Loop powered 2 wire, 24 volt direct current that accepts 4-20 milliampere direct current input.
2. NEMA 4X corrosion-resistant weatherproof housing with operating ambient temperature range from minus 10 to 55 degrees Celsius.
3. Scales in engineering units.
4. Nameplate describing function and scale units.

5. Liquid crystal diode, 3-1/2 digit digital display with accuracy of 0.1 percent, nominal 0.8 inch high.
6. NEMA 4X enclosure.

2.02 FLOW RATE AND FLOW TOTAL INDICATORS

A. Manufacturers: One of the following or equal:

1. Signet Scientific.

B. Features and Characteristics:

1. Loop powered 2-wire, 24 volt direct current that accepts 4-20 milliampere direct current input.
2. Engineering unit calibration with accuracy to within 2 percent and repeatability of 1 percent of full scale.
3. Ambient operating temperature range of 0 to 60 degrees Celsius.
4. Square root extraction within transmitter where indicated on the Drawings.

2.03 LOCAL TRANSMITTER INDICATORS

A. Manufacturers: One of the following or equal:

1. Signet Scientific.

B. Features and Characteristics:

1. Loop powered 2-wire, 24 volt direct current that accepts 4-20 milliampere direct current input.
2. NEMA 4X corrosion-resistant housing.
3. Minimum 2 inch scale with accuracy of within 2 percent, matching transmitter range or span, and calibrated in engineering units, not percentages.

2.04 ELECTRICAL TRANSDUCERS

A. Manufacturers: One of the following or equal:

1. General Electric Company.
2. Cutler-Hammer.
3. Square D Company.
4. Crompton Instrument-Paladin.

B. Features and Characteristics:

1. Root mean square current, root mean square voltage, active power in watts, volt-ampere reactive power, apparent volt-ampere power, frequency, phase angle, and integrating current (maximum demand) as indicated on the Drawings.
2. Input capacity to accept zero to 5 amperes current and zero to 120 volt alternating current voltage.
3. Output capacity of 4-20 milliamperes direct current into zero to 500 ohm load.
4. Able to withstand surges in accordance with ANSI C 37-90a where applicable.

2.05 2 VALVE MANIFOLDS

A. Manufacturers: One of the following or equal:

1. Anderson Greenwood and Co., Model PTM.

B. Features and Characteristics:

1. Type 316 stainless steel construction.
2. 1/2 inch national pipe thread process connection and bleed/calibrate valve between block valve and outlet port.

2.06 3 VALVE MANIFOLDS

A. Manufacturers: One of the following or equal:

1. Anderson Greenwood and Co., Model N4T.
2. HEX, Model HIM53.

B. Features and Characteristics:

1. Made with Type 316 stainless steel with Teflon stem packing.
2. 1/2 inch National Pipe Thread process and purge connections, unless specified otherwise.
3. 1/8 inch National Pipe Thread water purge connections.

2.07 ROOT VALVES

A. Manufacturers: One of the following or equal:

1. Anderson Greenwood, Model M5.
2. Hoke, Model 6800.

B. Features and Characteristics:

1. Made with Type 316 stainless steel.
2. One 1/2 inch National Pipe Thread male process connections.
3. Three 1/2 inch National Pipe Thread female instrument connections, one with bleed valve and unused ports with plugs.
4. Extended for installation on insulated pipes and vessels.

2.08 GAUGE VALVES

A. Manufacturers: One of the following or equal:

1. Anderson Greenwood, Model H1.
2. Hoke, Model 2100.

B. Features and Characteristics:

1. Made with Type 316 stainless steel.
2. Globe or angle pattern.

3. Two 1/2 inch National Pipe Thread ports.

2.09 DIAPHRAGM SEALS

A. Manufacturers: One of the following or equal:

1. Dresser Industrial Valve and Instrument, Ashcroft Type 101.
2. Ametek, Inc., Mansfield and Green Division, Type AG.

B. Features and Characteristics:

1. Type 316 stainless steel diaphragm and bottom housing, unless otherwise specified.
2. Bottom housing fitted with flushing connection, Type 316 stainless steel close nipple and valve cock.
3. Silicone oil fill fluid.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install two 2-valve instrument manifolds for each gauge pressure transmitter.

B. Bolt 3 valve manifolds at non-flange diaphragm type differential pressure transmitters in place of standard flange adapters.

C. Install root valves at process taps except insertion elements.

D. Install gauge valves on process connections to instruments where multiple instruments are connected to one tap or here root valves are not readily accessible.

END OF SECTION

SECTION 17400 Control Systems - SCADA SOFTWARE Additions

PART 1 GENERAL

1.01 SUMMARY

A. Section includes requirements for:

1. SCADA software modifications and additions to existing SCADA computers and SCADA programmable logic controllers (PLC) for the control and monitoring of process control associated with new Sludge Thickener No. 2 and Sludge Feed Pumps.

B. Related Sections:

1. The following Sections are related to the Work described in this Section..
   a. Section 17010 – Basic Measurement and Control Instrumentation Materials and Methods.
   b. Section 17411 – Control Strategies
   c. Section 17452 - Programmable Logic Controller

C. General requirements:

1. Contractor shall provide all necessary coordination and assistance to OWNER's Software Subcontractor, for testing and commissioning the software modifications and additions in existing SCADA computers and SCADA PLC, including testing functionality of all new graphics, to assure complete and operating control software system related to the new thickener and sludge feed pumps.
2. Contractor shall furnish to OWNER's Software Subcontractor copies of all related equipment shop drawing data for controls and instrumentation, including copies of field equipment testing verifying adequate termination of field wiring, testing of control loops and calibration of all field instruments.
3. Contractor shall furnish to OWNER's Software Subcontractor copies of all software logic in the thickener No. 2 control panel, for communication between thickener control panel and the plant SCADA system.

1.02 WORK BY OTHERS

A. Manatee County will provide under separate contract, all software additions and modifications to existing SCADA computers at the SEWRF command center and software control logic additions to existing PLC in SCADA panel "SP-3", located at the Thickener and Blower building No. 3

B. General requirements:

1. Owner's subcontractor will provide all Software modifications and additions in existing SCADA computers and SCADA PLC "SP-3", including all new graphics for a complete and operating control software system, to achieve the functionality

described in this and other sections through a combination of standard control system software and application software developed specifically for this project.

2. The standard control software listed in this section does not represent a comprehensive list of software necessary to implement the functional requirements of the specifications. Owner's software subcontractor will provide all necessary supplemental utility software and application software, as required, to meet the functional requirements of the Specifications.
3. The software must match the existing SCADA software.

1.03 SUBMITTALS

A. Furnish submittals in accordance with the project GENERAL CONDITIONS and section 17010.

B. Product Data:

1. Complete Manufacturer's brochures that identify SCADA software and options. Mark up to clearly show options and components to be provided, and cross out any options or components that will not be provided.
2. Manufacturer's installation instructions.

C. Graphic screens:

1. Color printouts of each graphic screen and control pop-ups.

D. Operation and Maintenance Manuals:

1. Complete installation, operation, and testing manuals.
2. Complete color printouts of each graphic screen and control pop-ups.

PART 2 PRODUCTS

2.01 SOFTWARE SERVICES

A. Owner's Software Subcontractor will provide the SCADA graphic software system to match existing.

1. Furnish graphic and text editor that allows custom formatting in order to customize and change the appearance of objects and text:
   a. Allow selection of different fill patterns to define object status.
2. As a minimum, provide the following object capabilities:
   a. Control List Selectors:
      1) Standard Control List.
      2) Piloted Control List.
   b. Global Objects.
   c. Display Objects:
      1) Bar Graph.
      2) Scale.
      3) Message Display.
      4) Multistate Indicator.
      5) List Indicator.

6) Numeric Data Display.

d. Screen Selector Objects:

1) Go To.
2) Return.
3) Screen List Selector.

e. Embedded Variables:

1) Time.
2) Date.
3) Numeric Variable.

f. Graphics:

1) Lines.
2) Shapes.
3) Freeform Drawings.
4) Imported Graphics.
5) Background Text.
6) Selection Table for standard ISA symbols.
7) PID Controller Faceplate.

g. Alarm screens.

3. Documentation:

a. Provide complete user documentation, including examples of how to operate the various modules within the system.

b. Provide the documentation in electronic format, HTML based with the ability to search for topics by keyword or search or specific text.

4. On-line Help:

a. Provide an on-line "help" facility, based upon Windows standard Hypertext:

1) Useful, context-sensitive information on the operation of the package:

a) That can be invoked on-line through a point-and-click operation.

b) The "help" facility must also support the ability to perform full text word search, add custom comments, bookmark topics, copy and pasting into another application, printing, and use of system fonts and colors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Refer to Section 17010.

B. All tags used and/or assigned as part of the application programming work are to use the Tag and Loop identifications found on the P&IDs.

C. Station Graphics:

1. Configure the graphic display for each device both in the treatment plant, and/or process area, including but not limited to:

a. Symbols for:

1) Pumps.
2) Valves.

3) HopperTank Level.
4) Flowmeters.
5) Pressure transmitters and switches.

b. Alarm symbols including equipment failure alarms.
c. Relevant test and operational data.
d. Status for each controller or controlled device:
1) Hand.
2) Off.
3) Automatic.
4) Local.
5) Remote.
6) Run.
7) Call.
8) Fail.
9) Open.
10) Close.
11) Hold.
12) Modulate.
e. Depict a change of state of pumps and valves by a change in color.

2. Screen graphics for Thickener No. 2.
a. Format shall match existing thickener No. 1 screen, unless otherwise required by Owner.
b. Graphic display of thickener No. 2
c. Associated piping and valves
d. Thickener wash water pump on-off
e. Thickener hydraulic pump on-off
f. Thickener belt drive on-off
g. Thickener sludge feed pump on-off
h. Thickener polymer pump on-off
i. Thickened sludge pump on-off
j. Was to GBT enable /disable button
k. Total WAS flow
l. Hopper level
m. Hopper minimum level set-point
n. Hopper maximum level set-point
o. GBT flow
p. GBT flow se-point
q. Belt speed (%)
r. Belt speed set-point
s. Polymer speed set-point
t. GBT mode hand-auto
u. GBT prewash cycle on-off
v. Thickener Ready
w. Wash-down cycle on-off
x. GBT alarms:
1) Belt drive fail
2) Belt broken
3) Belt misaligned
4) Low water pressure
5) High sludge level
6) Low Hydraulic pressure

7) Sludge Hopper high level

y. Discharge pump:

1) Manual – auto mode
2) Running status on-off
3) Pump speed (%)
4) Pump speed set-point

3. Modify screen graphics for existing sludge feed pumps

a. Sludge feed pump No. 5:

1) Pump control mode manual –auto
2) Pump control on-off
3) Pump status running –off
4) Pump alarm fail
5) Pump running time meter
6) Pump speed
7) Pump Speed set-point
8) Pump's seal water fail

4. In addition to Screens Graphics depicted by the P&ID drawings, provide a minimum of 2 additional screens, to be directed by the OWNER, during construction for the Sludge Tanks Improvements and related Thickener No. 2 project.

3.02 DEMONSTRATION AND TRAINING

A. Refer to Section 17010.

B. Owner's Software Subcontractor will provide training to plant operating personnel related to new additional SCADA graphics.

END OF SECTION

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SECTION 17411 CONTROL STRATEGIES

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies additional control strategies for the existing SCADA programmable logic controller (PLC) in SCADA panel “SP-3”, and supplemental control strategies for controller furnished by the manufacturer of the thickener No. 2.

B. The Owner’s software subcontractor will provide all necessary software and applications programming to implement the control strategies in SCADA programmable logic controller (PLC) in SCADA panel “SP-3”.

C. The Contractor shall provide all software associated with controller furnished by the manufacturer of the thickener No. 2.

D. The existing SEWRF plant control logic shall be maintained except as modified/expanded in the Contract Documents.

E. Control strategies describe sequential and interlocking control functions, analog control functions, color-graphic video display operator interfaces and alarm and event logging.

F. In each control strategy, the required SCADA monitoring, display, control and annunciation functions are described. See the referenced P&ID and related drawings on the required quantity. Provide all alarms as shown on electrical schematic diagrams even when they are not shown on P&ID’s. If an “overload” is shown on electrical drawing, provide this alarm even when it is not stated in the Control Strategies. P&ID drawings and electrical drawings are supplementary to each other.

G. H/O/A and L/O/R selector switches are both three-position selector switches and nomenclatures are used interchangeable between the two. H/A and L/R are two-position switches and nomenclatures are used interchangeable between the two. However, during the software programming, use the terminologies shown on the P&ID’s, unless otherwise required by Owner.

1.02 RELATED SECTIONS

A. 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.

1. Section 17010 – Basic Measurement and Controls Instrumentation
2. Section 17400 - Control Systems - SCADA Software Additions

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 CONTROL STRATEGIES

A. The following control strategies are included in this section:

1. Analog Point Status.
2. SCADA Inputs and Outputs Distribution and Control Requirements.
3. General Recording System.
4. General Contact/Logic System.
5. General Process Control Function (Analog) System.
6. Color Notation for Dynamic Objects on Control Graphic Display Screens.
7. Digital Alarm System.
8. Duty/Standby Control Logic.
9. Digital Status System and Software Elapsed Time Meters for rotary electrical equipment.
10. Modifications associated with thickener No. 1 and No. 2.
11. Modifications associated with sludge feed pump No. 5

3.02 CONTROL STRATEGY 1

A. General:

1. Each motor-driven piece of equipment shall have “RUNNING” status inputs to the Supervisory Control and Data Acquisition (SCADA).
2. The failure of driven equipment shall be monitored by the SCADA. Equipment shall be considered failed under the following conditions:
   a. The equipment is in AUTO and the SCADA attempts to operate the equipment and it does not respond within an adjustable time period.
   b. The equipment is in AUTO and running and for whatever reason other than the SCADA requesting the equipment to “STOP,” the equipment stops.
3. The SCADA system shall be used to the extent that it shall facilitate monitoring of the equipment.

3.03 CONTROL STRATEGY 2

A. Discrete Point Status:

1. Reference Drawings:
   a. All P&ID’s.
2. System Components:
   a. In accordance with P&ID’s.
3. Description:
   a. The status of each discrete input point shall be maintained in the SCADA system database. The status of each logical discrete point shall also be maintained in the SCADA system database. Logical points are points, which depend upon the status of several discrete input points.
   b. For example, an equipment failed logical status will result from a loss of READY status when running. Loss of READY status when NOT running will not result in a failed logical status.
4. SCADA Logic:

a. Calculate and maintain the status of all logical discrete status points in the SCADA database.

3.04 CONTROL STRATEGY 4

A. PLC Inputs and Outputs Distribution and Control Requirements:

1. Reference Drawings:
   a. Various P&ID's.
2. Description:
   a. Whenever there are sufficient modules based upon the physical inputs and outputs, PLC-I/O assignment shall be as shown on the PLC based SCADA Block Diagram and single line diagrams. Each pump/VFD I/Os shall be routed to its designated I/O modules. For example, pump/VFD 1 related I/Os shall be routed to its designated I/O modules while pump/VFD's 2, 3, 4, and 5 shall be routed to I/O modules designed for 2, 3, 4, and 5 respectively. No cross wiring will be permitted. Whenever there are not sufficient modules based upon the physical inputs and outputs for one pump/one dedicated module arrangement, then break signals for pumps into groups to minimize failure impact. For example, only two DI's and two DO modules are needed for 4 pumps, group two pumps into one DI and one DO, so that at least two pumps will still be available for service based upon one DI or DO module failure. Arrange inputs and outputs to PLC the most reliable method in minimizing module failure impact on the system. All the common I/Os shall be consolidated together in either one or two modules or as required at its respective PLC.
   b. Upon failure of a pump/VFD, SCADA shall intervene using equipment controlled by PLC and select the next pump/VFD in the lead-lag1-lag2-lag3 sequence for duty service.

3.05 CONTROL STRATEGY 5

A. General Recording System:

1. Reference Drawings:
   a. All P&ID's.
2. Description:
   a. The SCADA workstations shall generate reports based upon process variables (pressure, flow, temperature, level and analytical) and equipment status (run time, speed, and motor current) in real-time and from recent historical data. All instruments shown on the P&ID's with PI(R)xxxx, FI(R)xxxx, TI(R)xxxx, LI(R)xxxx, and AI(R)xxxx shall also be included under this recording requirement (where xxxx indicates instrument tag number). The exact report format will be determined by the OWNER during the submittal review period. Note that PI(R) stands for either PI or PIR. The same concept is applicable for process FI, TI, LI, and AI.
   b. All motors shall be included for recording of total elapsed time requirement. In other words, motor run times shall be programmed into the PLC.

3.06 CONTROL STRATEGY 6

A. General Contact/Logic System:

1. Reference Drawings:
   a. All P&ID's.
2. Description:
   a. All digital/logic control functions shall be provided as required and shall include but not be limited to the following:
      1) Digital/Logic Functions: The ability to perform logic and sequencing functions shall be supported to provide control interlocks, event sequencing and other logic operations.
      2) Boolean Algebra requirements: AND gate, OR gate, NAND gate, NOR gate, XOR gate, and NXOR gate.
      3) Logic requirements: Logic switch, logic compare, bi-directional time delay, and on-off with feedback.
      4) Ladder Logic requirements: NO contact, NC contact, energize coil, latch/unlatch coil, retentive timer on/off delay, up/down counter, counter/timer reset, ladder execution control, immediate input, and immediate output.

3.07 CONTROL STRATEGY 9

A. Color Notation for Dynamic Objects on Control Graphic Display Screens:

1. Reference Drawings:
   a. All P&ID's.
   b. All control strategies.
2. Description:
   a. All dynamic objects on control graphic display screens shall be provided with multiple-color display to identify status as tabulated below:

Equipment	**Status**	**Required Color**
Motor	Running	Green (to be verified during construction)
Motor	Stop	Red (to be verified during construction)
All above	Fault	Blinking Red-before acknowledgement Steady Yellow- after acknowledgement (to be verified during construction)

   b. If an "open" command has been given to a valve in its "closed" position, the green light shall be blinking during opening period.
   c. If a "close" command has been given to a valve in its "open" position, the red light shall be blinking during closing period.

3.08 CONTROL STRATEGY 10

A. Digital Alarm System:

1. Reference Drawings:
   a. All P&ID's, electrical control diagrams, and vendor drawings.
2. System Components:
   a. In accordance with P&ID's.
3. Description:
   a. All digital input alarms shall be provided as shown on P&ID's. Digital inputs can be from field instruments (level switches, pressure switches, etc.), local control panels (relay outputs, alarm module outputs, switches), and packaged systems (designated terminals of packaged units).
   b. Digital alarms shall be configured as alarms in SCADA and shown on screen.

Alarm Red Blinking	In alarm and unacknowledged
Solid Yellow	In alarm and acknowledged

   c. Touching the graphic alarm on screen shall acknowledge the alarm if the operator logged in has permission. SCADA alarm shall be logged with:
      1) When in alarm.
      2) When the alarm was acknowledged.
      3) Who acknowledged the alarm.
      4) When its alarm was out.

3.09 CONTROL STRATEGY 12

A. Digital Status System:

1. Reference Drawings:
   a. All P&ID's, electrical control diagrams, and vendor drawings.
2. System Components:
   a. In accordance with P&ID's.
3. Description:
   a. All digital input status shall be displayed on SCADA screens as required by the reference drawings and specifications. Each digital input shall be shown in its appropriate process screen and/or equipment status screen. Digital inputs can be originated from field instruments (motorized actuators, power management related contact inputs, level switches, pressure switches, etc.), local control panels (relay outputs, alarm module outputs, switches), and packaged systems (designated terminals of packaged units).
   b. Whenever an electrical rotary equipment is started successfully, a run contact input will be fed to PLC input module. The PLC shall start the software time to totalize the elapsed time of the equipment, such as an electrical motor. This is applicable to all KQI's shown on P&ID's.

3.10 SLUDGE THICKENER (S)

A. References:

1. P&ID's
2. Electrical and mechanical drawings.

B. General Description:

1. One Local Control Panel shall be provided by the thickener manufacturer in having an overall coordinated control system for the entire packaged system. This packaged system shall have the Local Manual (start/stop) and Local Automated operation modes. When the system is placed in Local Manual Position and a Start Command has been initiated, the mechanical drive shall run continually. The permissive interlocks could shut down the system. The reset pushbutton shall be activated in order to restart after the start-up permissive interlocks are satisfied. When the system is placed under the Local Automated operation mode, the system shall be able to start automatically either by the high differential level (upstream and downstream) or by the cycle timer (on/off). The high differential level set point and the cyclic timers (on timer and off timer) shall be adjustable and shall also be adjustable from the plant PLC/SCADA, when the L/O/R selector switch is placed in Remote Position.
2. All the mechanical and electrical devices status shall be fed back to the PLC/SCADA as shown on P&ID and as specified in mechanical and electrical specification.

C. Manual Thickener Control:

1. The plant operating personnel will make decisions about the preferred thickener No. 1 or thickener No. 2 to be used. Only one thickener is anticipated to be needed to meet the required sludge thickening process.
2. The plant operating personnel will manually open and close sludge feed valves to allow sludge flow into the respective thickener No.1 or thickener No. 2.
3. The plant operating personnel will manually initiate start-stop functioning of the thickener.
    a. Upon manual initiation of the thickener equipment, the thickener controls are set in automatic control mode.

D. One Local Thickener Control Panel "TCP-2" shall be provided by the thickener manufacturer in having an overall coordinated control system for the entire packaged system. This packaged system shall have the Local Manual (start/stop) and Local Automated operation modes.

1. Automatic thickener process control:
    a. The pre-wash cycle shall automatically begin
    b. Thickener controls verify no alarm conditions
    c. Plant operator manually selects the GBT flow set-point
    d. Plant operator manually selects the polymer speed set-point
    e. Plant operator manually selects the sludge hopper minimum and maximum level set-points
    f. Plant operator manually enables WAS pumping to GBTs
    g. GBT controller display "READY" mode light upon checking normal condition of pre-wash and automatic starting cycle

2. The GBT automatically runs according to the plant operating set-points.
3. The GBT controller continuously transmits equipment status, drive speeds to the plant SCADA system, according with required SCADA graphic displays specified in section 17400.
4. The plant PLC/SCADA has no control over the thickener packaged system. The plant PLC/SCADA will have the monitoring and alarm functions as required by the packaged system manufacturer and as shown on P&IDs and as specified in the specifications.

3.11 SLUDGE FEED PUMP No. 5

A. References:

1. P&IDs
2. Electrical and mechanical drawings

B. General Description:

1. There are three sludge feed pumps located between Holding Tanks Nos. 1 & 2, which re-cycle sludge from the holding tanks and pumps sludge to the thickener. Two of the pumps have dedicated variable frequency drives (VFDs). This project will add a Feed pump No. 5 with a VFD speed controller.

C. Local Control:

1. Manual Control:
   a. The Sludge pump shall have a local Hand/Off/Auto selector switch and Local/Remote selector switch at the VFD. When the selector switch is in the LOCAL and Manual position, the STOP and START pushbuttons on the pump will be enabled. When the selector switch is in the Auto position, the pump speed can be adjusted at the VFD.
   b. When the selector switch is in the REMOTE position, the pumps shall be controlled through the SCADA system.
2. Automatic Control:
   a. Each sludge feed pump shall contain temperature probes and seal water flow switches with contacts that will shut down the pump upon high temperature and/or no seal water flow.
3. Alarming (at VFD):
   a. Pump’s fail alarm.
   b. High pump motor temperature.
   c. Pump’s seal water not running

D. PLC/SCADA Control:

1. Manual sludge feed pump control:
   a. The SCADA system shall have AUTO/MANUAL selector switch at the workstation. When selector switch in MANUAL mode, the pump may be operated manually from the SCADA system using START/STOP push buttons at the workstation. The pump’s speed set point will be manually selected by plant operator at the SCADA screen
2. Automatic sludge feed pump control:

a. When the selector switch is in AUTO mode, the plant operator may control the sludge pumps speed based on a total sludge flow rate and the pump's speed set-point.

3. Monitoring:
   a. The SCADA system shall indicate pump status according with symbols shown on P&ID drawings, including AUTO ready status, elapsed time or running hours.
   b. The SCADA system shall indicate the VFD pump speed signal as a percentage (0 to 100 percent).
4. Alarming:
   a. A pump fail alarm shall be transmitted to the SCADA system from each VFD.
   b. High pump motor temperature alarm.
   c. No flow of pump's seal water.

END OF SECTION

SECTION 17442 INSTRUMENT AND CONTROL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements for sludge thickener No. 2 control panel (TCP-2) specified in section 11230.
2. General requirements for modifications and additions to existing SCADA PLC control panel (SP-3), as necessary for the control and monitoring of sludge thickener equipment and sludge feed pumps.

1.02 REFERENCES

A. National Electrical Code (NEC): Article 250 Grounding.

B. National Electrical Manufacturer's Association (NEMA):

1. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).

C. Instrument Society of America (ISA):

1. ANSI/ISA-S5.4 Instrument Loop Diagrams.

1.03 SYSTEM DESCRIPTION

A. The control panel for the sludge gravity belt thickener No. 2 shall be new as specified in section 11230.

B. The existing SCADA panel SP-3 was originally manufactured and supplied in year 2002, by GE Team Controls, a Division of GE Industrial System Solutions and GE Automation Services, under their project number GEAS 161012 and a copy of the record drawings and O&M manual will be available to the Contractor.

1. The existing PLC panel controls the existing sludge gravity belt thickener No. 1 and aeration blowers located in blower/electrical room building No. 3.
2. The panel shall be maintained in continues operation during the addition of points associated with new sludge thickening equipment and sludge feed pumps.
3. The existing PLC cabinet has prewired system between PLC modules and terminal blocks for field wiring.
4. The existing PLC cabinet has spare input/output points reserved for the connection of wiring associated with the sludge feed pumps.
5. Provide if necessary, any additional I/O control modules for the connection of new associated monitoring points.
6. Provide necessary surge protective devices for each additional points connected to the PLC panel.

1.04 SUBMITTALS

A. Shop Drawings:

1. Internal interconnecting wiring diagrams showing terminal strips and all external devices connected to the panel as specified in Section 17010, design submittal for loop and schematic diagrams.
2. Complete schematic and diagrams including terminal block and wire identification numbers and device location symbols consistent with the Contract Documents.
3. Complete schematic and diagrams including terminal block and wire identification numbers and device location symbols consistent with the Contract Documents.
4. Panel bill of material with detailed description of components and equipment data sheets.
5. Field cable number/I.D. and terminations.
6. Factory data sheets for instrumentation.

1.05 QUALITY ASSURANCE

A. Loop Field Tests.

B. Verification of satisfactory performance for points associated with Sludge Thickeners No. 1 and No. 2

PART 2 PRODUCTS

2.01 NEW PANEL CONSTRUCTION AND MODIFICATIONS TO EXISTING PANELS

A. The general fabrication requirements for the instrument and control panels including enclosures and sub-panels shall be as specified herein.

B. Cabinets and Enclosures as specified in section 16135.

C. Air conditioning equipment for outdoor cabinets with electronic products as specified in section 16135.

D. Programmable logic controller (PLC) products as specified in section 17452

E. Interconnecting wiring and wiring to terminals for external connection shall be MTW or SIS 16 AWG, stranded copper wire, insulated for not less than 600 volts, with a moisture-resistant and flame-retardant covering rated for not less than 90 degrees Celsius except for electronic circuits and special instrument interconnect wiring which shall be in accordance with manufacturer requirements.

F. Panel Wiring Size:

1. Power distribution wiring on line side of panel fuses minimum 12 AWG.
2. Secondary Power Distribution Wiring and Wiring for Control Circuits: Minimum number 14 AWG.
3. Annunciator and Indicating Light Circuits: Minimum 18 AWG (within panel).
4. Electronic Analog Circuits Within Instrument and Control Panels: Minimum 18 AWG twisted and shielded pairs or triads rated not less than 600 volts.

G. Analog Circuits and AC Power Circuits: Separated.

H. Internal Panel Wiring Colors:

1. AC Power Distribution: Red
2. DC Power and Control: Blue
3. Instrument: Black and white twisted shielded pair.
4. Other and in agreement with manufacturer's wiring diagrams as stated on manufactured drawing legend.

I. Surge Protection Device for Power Entrances: Nominal 120 volts AC with a nominal clamping voltage of 200 volts; nonfaulting and noninterrupting design with a response time of not more than 5 nanoseconds.

J. Terminal Blocks for External Connections: Suitable for specified AWG wire, rated 30 amperes at not less than 600 volts; with marking strip, covers, pressure connectors, and labeled terminals, each conductor of external circuits plus one ground terminal for each shielded cable. Provide minimum 25 percent spare terminals.

K. Group cables, and firmly support wiring to the panel. Provide minimum 8 inches clearance between terminal strips and the base of vertical panels for conduit and wiring space. Individually fuse each control loop or system, and clearly label and locate fuses or circuit breakers for maintenance.

L. Furnish and install equipment grounding conductor in accordance with NEC 250. Provide power ground lugs. Provide signal insulated and isolated ground lugs.

M. Nameplates on Internal and External Instruments and Devices: Materials approximate dimensions with legends as indicated on the Drawings made of laminated phenolic material having engraved letters approximately 3/16 inch high extending through the black face into the white layer; firmly screwed to panels with stainless steel fasteners. No penetration through the panel front will be permitted. Refer to Section 17010.

N. Fabricated Custom Panels: Thoroughly clean, sand, and apply minimum 2 coats of rust inhibiting primer both inside and out of panels. Apply minimum 2 coats of white enamel or lacquer on panel interior surfaces. Smooth exterior surfaces and apply minimum 2 coats of enamel, polyurethane, or lacquer finish. Furnish 2 quarts of finish color paint with the panels to cover future scratches.

O. Provide panels with an inside pocket to hold the panel drawings. Ship panels with 1 copy of accepted submittal drawings in a sealed plastic bag stored in the panel drawing pocket.

2.02 PANEL ACCESSORIES

A. Surge Protectors:

1. Manufacturers: One of the following or equal:
   a. Transector ACP-100 BW.
   b. Power Integrity Corporation ZTAS.
   c. Entrelec.
   d. Weidmuller.
   e. Phoenix Contact.

B. Terminal Blocks:

1. Manufacturers: One of the following or equal:
   a. Allen-Bradley.
   b. Entrelec.
   c. Phoenix Contact.
   d. Wago.
2. Nickel plated copper only; DIN rail; universal foot with the following as required for the application:
   a. Universal type.
   b. Feed through.
   c. Ground.
   d. Neutral disconnect.
   e. Intrinsically safe.
   f. Explosion-proof.
   g. Fuse.
   h. Knife disconnect.
   i. Ground fault indicator.
   j. Bolt connecting.
3. Terminal Block Labeling: Each terminal and each conductor as previously specified with machine labels only.

C. Signal Interface Modules:

1. Manufacturers: One of the following or equal.
   a. Phoenix Contact.
   b. Entrelec.
   c. Action.
2. Analog isolating converter.
3. Ground loop isolations.
4. Signal amplification.
5. Signal level matching.
6. 24 VDC power supply (120 VAC input).

D. Fiber Patch Panels: The fiber patch panel shall be for cabinet mounting and include the necessary fiber connectors for incoming cable and outgoing patch cords. Patch panels shall be manufactured by Corning Cable Systems or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install gasket and sealing material under panels with floor slab cutouts for conduit. Undercoat floor mounted panels.

B. Install conduit gasket, sealing material, and NEC Article 500 Seal-Off as specified in Division 16.

C. CONTRACTOR shall install grounding conductor and grounding electrode as required by the panel manufacturer.

D. Connect panel equipment grounding (safety) terminal to the building or facility ground grid with 6 AWG green insulated conductor.

E. No panel penetrations shall be made in the top of a panel. Conduit connections to panel shall be made by using “O” ring Myers hub with bonding screw nut and maintain spacing per UL recommendations.

3.02 PROTECTION

A. Protect products until acceptance by OWNER.

END OF SECTION

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SECTION 17444 INPUT / OUTPUT (I/O) REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Review P&IDs drawings, electrical drawings, control strategies and packaged systems related shop drawings to determine the quantity and provide actual I/O requirements and materials take-off, for connections to new control panels and/or existing PLC terminal blocks and control modules.

B. All signal originating devices, when connected to PLC, shall be labeled as either DI (Digital input or contact input) or AI (Analog input). There are cases where input devices originating from electrical discipline, such as an electrical starter run “M” contacts which do not have instrument tag, then the recipient device will be labeled as DI to count as one digital input for the project.

C. See additional I/O points related to electrical equipment. At the existing PLC panel provide the required I/O connections.

D. There are also cases where the input to PLC cannot be shown as a separate signal (to avoid the signal congestion on P&IDs). The recipient device will be listed as a DI to count as one digital input.

E. Consider 2 digital (contact) outputs for dual modes of operation, such as “Opening” and “Closing” modes of operation for a motorized valve or a motorized gate.

F. Pilot lights are usually shown without any tag numbers. Provide appropriate type of DO modules for indication or alarming functions.

G. Special care and attention is needed when reading P&IDs, especially regarding to incidental or auxiliary control items like temperature instruments. Due to limited available space on P&ID, all auxiliary, temperature and related instruments are not shown for clarity.

H. Whenever multiple process trains are involved, for clarity tables will be used in lieu of on train per drawing. The second train related instruments will no longer appear. Follow the notes and table for the proper material take-off and I/O count. However for OIS (Operator Interface Station) or HMI (Human Machine Interface) usage, configure and program all and provide graphic display screens on a one screen/train approach.

1.02 I/O POINTS

A. Determine and provide the required quantity of I/O points from related process and instrumentation diagrams and from electrical control schematics.

END OF SECTION

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SECTION 17452 PROGRAMMABLE LOGIC CONTROLLER SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for PLC hardware and software provisions in control panel for the sludge gravity belt thickener No. 2, to be supply under the scope of work of the Manufacturer and Supplier of equipment specified in section 11230.
2. Requirements for additions of PLC hardware and wiring termination in existing SCADA PLC panel SP-3.

1.02 SUBMITTALS

A. Shop Drawings and Product Data: Include description of components, methods of connecting components, and the following:
1. Product data for new equipment in sludge thickener No. 2 control panel
a. Manufacturer's literature of programming software.
b. Copy of the programmable logic controller program on compact disk.

2. Product data for additions of hardware to existing SCADA PLC Panel SP-3.

B. Operating and Maintenance Manuals. Include the following:

1. Programming procedures.
2. System specifications.
3. Electrical power requirements.
4. Application considerations.
5. Explanation of internal fault diagnostics.
6. Assembly and installation procedures.
7. Troubleshooting procedures.
8. Powering up procedures.
9. Shutdown procedures.
10. Recommend spare parts list.

1.03 QUALITY ASSURANCE

A. Existing PLCs are Allen-Bradley SLC-500 Series in cabinet SP-3 at the Blower and MCC Building No.3.

B. New PLC hardware and software in sludge gravity belt thickener No. 2 shall match the quality and type of existing SCADA PLC system, for Owner's convenience of maintenance and stocking of common spare parts.

C. Programming Qualifications and Services:

1. Contractor shall provide services for testing all control loops and any additional services necessary, to verify adequate termination of new wiring in sludge thickener No 2 control panel and existing PLC cabinet SP-3.
2. All software /programming services in new sludge thickening control panel No. 2 shall be provided by Contractor and sludge thickening system Supplier.

3. All software /programming services in existing PLC controllers SP-3 and SCADA computer will be provided by Owner.

D. Provide a single source responsibility for terminating new wiring in programmable logic controller system

E. Design and test the additions to the programmable logic controller system to operate in an industrial environment per NEMA Standard UCS 2-230 (Arc Test) and IEEE C37.90a CSWC.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Environmental Rating for Components of the Programmable Logic Controller System, Except the Programming Equipment:

1. Humidity: Maximum 95 percent, non-condensing.
2. Ambient Temperature:
   a. Operational: Zero to 60 degrees Celsius.
   b. Storage: Minus 40 to 80 degrees Celsius.

B. Electrical Service: 120 VAC, single phase, 50/60 Hertz.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Existing Programmable Logic Controller (PLC) System in SCADA panel SP-3

1. Allen-Bradley SLC500 Series
2. Allen-Bradley 13 slot I/O rack 1746-A13
3. Allen-Bradley CPU processor 1747-L542
4. Allen-Bradley 120 V discrete input modules 1746-IA16
5. Allen-Bradley 120 V discrete output modules 1746-DW16
6. Allen-Bradley isolated analog input modules 1746-NI8
7. Allen-Bradley isolated analog ouput modules 1746-NO41
8. Allen-Bradley power supply module 1746-P4
9. Optical communication module – Phoenix Digital # OLC-DPR-B5-D-ST

2.02 HARDWARE IN SCADA PANEL SP-3

A. Provide PLC hardware to match products in existing SCADA Panel SP-3.

B. Provide additional or new Optical communication module – equal to Phoenix Digital products, as necessary to communicate with existing fiber optic patch panel in the

following:

1. Remote existing SCADA panel SP-4
2. Existing sludge thickener No. 1 control panel
3. New sludge thickener No. 2 control panel

2.03 PLC IN THICKENER CONTROL PANEL No.2

A. Provide PLC hardware and software to match products in existing SCADA Panel SP-3.

B. Programmable Logic Controller System: Underwriter Laboratories listed and CSA approved; Modular, capable of field expansion with additional hardware and software to allow tailoring of the system to process control applications.

C. Processor, and Input and Output Circuitry: Modular, capable of interchangeability with similar modules to upgrade the system.

D. Modules: Devices that plug into chassis with key that allows installation in only one direction and prevents improper module placement.

E. System and Signal Power to the Processor, Interface, and Memory Modules: On a single motherboard or backplane with no interconnecting wiring between modules via plug-terminated jumpers.

F. Processor Input and Output Modules: Uniquely numbered so each can be readily identified.

G. Cooling of System Modules, and Main and Expansion Chassis: Free air flow convection, without internal fans or other means of cooling, except heat sinks.

H. When programmable logic controller losses outside electrical power:

1. Output shall turn off.
2. Internal battery shall provide power to retain user logic, controller configuration information, and data register contents for at least 9 months.

I. Diagnostic LEDs: Capable of indicating major status conditions of the programmable logic controller.

1. Upon power-up or power recovery, the programmable logic controller shall self-test operation of the microprocessor, check memory for integrity, verify communication between boards, and reset and resume the logic solving scan only when satisfactory.
2. During each processing cycle, the programmable logic controller shall execute diagnostic routines or critical components within the system. Run-time diagnostics shall determine causes of errors, flag causes, and locate failed I/O modules.
3. Diagnostic information shall be available to maintenance personnel through the use of a computer based interface or other memory access devices.

J. Software shall be Rockwell – Allen Bradley RSLogix 500 to match existing.

1. Furnish Operating Software capable of monitoring and/or control of the PLCs via the PLC data network:

    a. Contain diagnostics to collect troubleshooting and performance data and display it in easy to understand graphs and tables.
    b. Monitor devices at each drop on the PLC data network for proper communications.
    c. Provide the ability to program all PLCs on the PLC data network from the SCADA Console.

K. Provide Fiber Optical patch panel for communication to SCADA network in PLC cabinet SP-3.

2.04 FIELD WIRING CONNECTORS AND TERMINAL BLOCKS

A. I/O Connectors: Attached directly to I/O housings so that modules can be quickly and easily removed without disturbing or flexing the field wiring; with screw terminals. Model number shall be 1492-ACABLE XX Series or 1492-CABLE-XX Series.

E. Existing SCADA panel SP-3:

1. The existing PLC cabinet has prewired system between PLC modules and terminal blocks for field wiring.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install devices related to the programmable logic controller system in accordance with the programmable logic controller manufacturer's instructions and recommendations, including grounding specifications.

3.02 FIELD QUALITY CONTROL

A. Perform conducted susceptibility (RFI, EMI) test as outlined in NEMA ICS 2-230, NEMA ICS 3-304-42, section 2 of IEEE 472-1974 and ANSI C37.90A-1974.

B. Subject completed programmable logic controller units to a burn-in test of 60 degrees Celsius for at least 96 hours.

3.03 DEMONSTRATION

A. Establish a mutually agreed upon time for demonstrations with the ENGINEER.

B. Deliver written notification of demonstrations to ENGINEER at least 7 days before demonstrations. Include an agenda for the demonstration and testing procedures with notification.

C. Demonstrate functional operation of programmable logic controller system hardware and logic program at system assembly location prior to shipment.

D. Demonstrate full functional operation of programmable logic controller system hardware and logic program at the Project jobsite when fully integrated to the field I/Os.

END OF SECTION

SECTION 17460 PRESSURE MEASUREMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Requirements for new pressure gauges and pressure switches

B. Provide new pressure gauges shown on the P&ID drawings and mechanical drawings for new sludge feed pump and thickened sludge discharge pump

1.02 SUBMITTALS

A. Submit product data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: One of the following or equal:

1. Ashcroft: Model 1379
2. Wika.
3. Ametek U.S. Gauge.

2.02 MANUFACTURED UNITS

A. General:

1. Pressure gauge assembly shall include pressure sensing element, gauge case, and dial mechanism.

B. Performance requirements:

1. Pressure range:
   a. As specified in the Contract Documents.
2. Accuracy:
   a. Grade 2A, as defined by ASME B40.100.
   b. ±1.0 percent of span after friction errors are eliminated by tapping or vibration.
   c. Maximum allowable friction inaccuracy: ±1.0 percent of span.
3. Element:
   a. Where the maximum pressure is less than 10 psi, provide socket and bellows; for all other pressure ranges, employ a Bourdon tube.
   b. Socket tips for bellows and Bourdon tube:

1) Materials: Type 316 stainless steel.

c. Overpressure: Minimum 130 percent of maximum range pressure without damage to gauge or sensing element.

d. Wetted materials: 316 stainless steel.

4. Dial gauge:

a. Dial size: 4-1/2 inches.

b. Dial case material: Stainless steel

c. Provide safety gauge with rupture disk and blow out back.

d. Dial face: Gasketed shatterproof glass or polycarbonate.

e. Provide gauge locks where possible.

f. Connection and mounting:

1) Direct mounted and suitable for outdoor installation.

2) 1/2 inch NPT.

3) Connection material: Stainless steel.

g. Pointer: Externally adjustable.

2.03 ACCESSORIES

A. Provide means for gauge isolation:

1. Mount valve manifold integrally to the gauge.
2. Valve manifold and pressure gauge shall be assembled by manufacturer and shipped as an assembly.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.02 ADJUSTING

A. Verify factory calibration of all instruments in accordance with the manufacturer’s instructions:

1. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.03 DEMONSTRATION

A. Demonstrate performance of all instruments to the ENGINEER before commissioning:

END OF SECTION