

**MANATEE COUNTY GOVERNMENT  
INVITATION FOR BID (IFB) #09-0670-OV  
IMPROVEMENTS to the TARA #20 MASTER LIFT STATION  
(Project No. 6022087)**

Manatee County, a political subdivision of the State of Florida, (hereinafter "Manatee County" or the "County" or "Owner") 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.

**INFORMATION CONFERENCE**

In order to insure that all prospective bidders have sufficient information and understanding of the County's needs, an **information conference** will be held **January 30, 2009 at 1:00 PM** at the Manatee County Administrative Center, 1112 Manatee Avenue West, **Suite 502, Manatee Conference Room, 5<sup>th</sup> Floor**, Bradenton, Florida. All interested bidders are encouraged to attend.

**NOTE:** Article B.04 Inspection of Site shall be a requirement to be considered for this bid. Contact Information for Site Visitation included in Article B.04. **Site Visitation Immediately following Information Conference.**

**TIME AND DATE DUE: Friday, February 20, 2009 at 3:00 PM**

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Drawings Improvements to the Tara #20 Master Lift Station (20 Total Pages / Signed & Sealed 11/20/2008)	November 2008

**Important Note:** A prohibition of Lobbying has been enacted. Please review paragraph A.24 carefully to avoid violation and possible sanctions.

**FOR INFORMATION CONTACT: Olga Valcich**

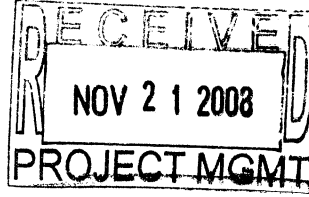
(941) 749-3055 FAX (941) 749-3034

Email: [olga.valcich@mymanatee.org](mailto:olga.valcich@mymanatee.org)

AUTHORIZED FOR RELEASE: 



November 20, 2008



To All Bidders

**Subject: Improvements at Tara #20 Master Lift Station**

The "construction cost estimate" for Improvements at Tara #20 Master Lift Station is \$1,700,000.00 (one million, seven hundred thousand dollars and no cents)

This construction cost estimate was determined as of November 20, 2008. The construction cost estimate is based on the original specifications and drawings issued November 2008. Changes to the specifications subsequent to the original documents by addenda to this bid may not be accounted for in this construction cost estimate.

Sincerely,

**URS Corporation**

Craig P. Osramski, P.E.  
Project Manager  
Water/Wastewater Group  
Engineer of Record for Improvements at Tara #20 MLS

- cc: Tim Hochuli, Director, Project Management Department
- Bruce Simington, Senior Project Manager
- Jeff Mertens, Project Manager
- Sue Sandhoff, Fiscal Services Manager
- Manatee Co. Project File: 6022087
- URS File 12007391 (6300)

URS Corporation  
7650 West Courtney  
Campbell Causeway  
Tampa, FL 33607-1462  
Tel: 813.286.1711  
Fax: 813.287.8591

6022087

5.0



SECTION 00010  
**INFORMATION TO BIDDERS**

**A.01 OPENING LOCATION**

These bids will be publicly opened at Manatee County Purchasing, 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.

**A.02 BID INFORMATION AND BID DOCUMENTS**

Manatee County Purchasing Division posts **notices of bid or proposal opportunities and addenda** on the Purchasing Division's web page at <http://www.mymanatee.org> which can be accessed by clicking on the "Purchasing" button on the left side of the screen and then clicking on the "Bids and Proposals" button and **on the County's document distribution service at <http://www.demandstar.com>.**

Electronic copies of Bid or Proposal documents may be requested at no cost per Florida Statute 119.01 (2) (e). These files in PDF format may be obtained by calling the person or persons identified to contact on page one.

A fee may be charged for creating a CD copy of the requested documents. Cost Details shall be provided when you specify the format.

The **documents are available in a portable document format (.PDF) files** which you may view and print using Adobe Acrobat software. You may download a free copy of this software (Adobe) from the County's web page if you do not have it.

Onvia **DemandStar** provides direct electronic distribution of email/fax notices of the agency's formal bid or proposal opportunities, at no charge. The distribution lists provided by this service are supplemented by the County.

Vendors may choose to download individual documents from DemandStar for a download fee posted on that service's website. Vendors may contact DemandStar regarding an agency level subscription option that allows vendors to download bid documents and transact business with any one (1) agency for free. If a vendor chooses to increase the number of agencies beyond their single agency, subscription fees based on the level of service chosen will apply.

Documents may be purchased from Onvia DemandStar. The cost for copies of documents purchased from Onvia DemandStar is established per document and the cost information is published as part of the specific Proposal detail, subsection "Pre Bid Conference" on the Onvia DemandStar web pages.

**A.02 BID INFORMATION AND BID DOCUMENTS (Continued)**

**Award Document/Recommendations** appear on the Onvia DemandStar web page.

**Notices of Source Selections** appear on the Onvia DemandStar web page and the County's web page (Financial Management – Purchasing Division).

Onvia DemandStar may be directly contacted at <http://www.demandstar.com> or by calling 800-331-5537, if you have any questions.

**IMPORTANT NOTE: AUTOMATED NOTICES OF ADDENDA ARE ISSUED ONLY VIA THE DEMANDSTAR "PLANHOLDER" DISTRIBUTION SYSTEM.**

**IF YOU OBTAIN A COPY OF THIS BID DOCUMENT FROM OTHER THAN REGISTERING WITH ONVIA DEMANDSTAR WEB SERVICE FOR THIS SPECIFIC BID / PROPOSAL – YOU SHALL NOT RECEIVE AUTOMATED NOTIFICATIONS OF ADDENDA.**

**IT IS THE RESPONSIBILITY OF EACH BIDDER OR PROPOSER, PRIOR TO SUBMITTING THEIR BID OR PROPOSAL, TO CONTACT THE MANATEE COUNTY PURCHASING OFFICE (see contact information on page one) TO DETERMINE IF ADDENDA WERE ISSUED AND TO MAKE SUCH ADDENDA A PART OF THEIR BID OR PROPOSAL.**

Please contact the individual named on the first page of this bid or proposal document, if you have any questions on this instruction.

**Paper copies of bid or proposal documents may be purchased from DemandStar or by contacting our County Public Works Department, Project Management Division located at 1022 26<sup>th</sup> Street East, Bradenton, FL 34208. The Phone No. is 941-708-7450, Extension 7349. Hours of operation: 8:00 A.M. to 4:00 P.M. Monday thru Friday. There is no charge for the drawings and bid documents.**

**A.03 BID FORM DELIVERY REQUIREMENTS**

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 Manatee County Purchasing for receipt on or before the stated time and date. If a bid is sent by U.S. Mail, the bidder shall be responsible for its timely delivery to Purchasing. Bids delayed by mail 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. Telegraphic bids and/or facsimile bids will not be considered.

**A.04 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 the Invitation for Bid shall be made through the Manatee County Purchasing Office. The 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, the County will BROADCAST THE ADDENDA ON ONVIA DEMANDSAR TO "PLANHOLDERS" IDENTIFIED ON THIS WEB SERVICE**, however, it shall be the responsibility of each bidder, prior to submitting their bid, to contact Manatee County Purchasing Office (see contact on page 1) to determine if addenda were issued and to make such addenda a part of their bid.

**A.05 SEALED & MARKED**

One original and two copies of your **signed bid** shall be submitted in one sealed package, clearly marked on the outside "**Sealed Bid #09-0670-OV, Improvements to the Tara #20 Master Lift Station, Bradenton, FL** with your company name and addressed to:

Manatee County Purchasing  
1112 Manatee Avenue West, Suite 803  
Bradenton, Florida 34205

**A.06 LEGAL NAME**

Bids shall clearly indicate the legal name, address and telephone number of the bidder. Bids 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.

**A.07 BID EXPENSES**

All expenses for making bids to the County are to be borne by the bidder.

**A.08 IRREVOCABLE OFFER**

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

**A.09 DISCLOSURE**

Upon receipt, all inquires and responses to inquires related to this Invitation for Bid or Request for Proposal become "Public Records" and are subject to public disclosure consistent with Chapter 119, Florida Statutes.

**Bids or Proposal become "Public Records" ten (10) days after the proposal opening or if an award decision is made earlier than this time as provided by Florida Statute 119.07,** No announcement or review of the bid or proposal documents shall be conducted at the public opening of the proposals.

**A.10 RESERVED RIGHTS**

The County reserves the right to accept or reject any and/or all bids, to waive irregularities and technicalities, and to request resubmission. Also, the 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 the County. Any sole response received by the first submission date may or may not be rejected by the County depending on available competition and current needs of the 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 conforms closest to or most exceeds the quality of goods and/or services set forth in the attached Contract Documents or otherwise required by the 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 this Invitation For Bid. To be a responsible bidder, the bidder shall have the capability in all respects to perform fully the contract requirements, and the tenacity, perseverance, experience, integrity, reliability, capacity, facilities, equipment, and credit which will assure good faith performance. Also, the County reserves the right to make such investigation as it deems necessary to determine the ability of any bidder to deliver the goods or service requested. Information the 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.11 COLLUSION**

By offering a submission to this Invitation For Bid, the bidder certifies that the bidder has not divulged, discussed or compared their bid with other bidders, 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 contract to be entered into; and
- e. no person or agency has been employed or retained to solicit or secure this contract upon an agreement or understanding or a commission, percentage, brokerage, or contingent fee excepting bona fide employees or established commercial agencies maintained by bidder for purpose of doing business.

#### A.12 APPLICABLE LAWS

Bidder or Proposer 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 agreement. Any involvement with any Manatee County procurement shall be in accordance with Manatee County Purchasing Code Ordinance 08-43, as amended. An actual or prospective Bidder or Proposer who is aggrieved in connection with the solicitation or award of a contract may protest to the Board of County Commissioners of Manatee County as required in Section 2-26/61 of the Purchasing Code.

A protest with respect to this Invitation For Bid or Request for Proposal shall be submitted in writing prior to the scheduled opening date of this proposal, unless the aggrieved person did not know and could not have been reasonably expected to have knowledge of the facts giving rise to such protest prior to the scheduled opening date of this proposal. The protest shall be submitted within seven calendar days after such aggrieved person knows or could have reasonably been expected to know the facts giving rise thereto.

#### A.13 CODE OF ETHICS

With respect to this proposal, if any Bidder or Proposer violates or is a party to a violation of the Code of Ethics of Manatee County per Manatee County Purchasing Code Ordinance 08-43, Article 3, Ethics n Public Contracting, and / or the State of Florida per Florida Statutes, Chapter 112, Part III, Code of Ethics for Public Officers and Employees, such Bidder or Proposer may be disqualified from performing the work described in this proposal or from furnishing the goods or services for which the proposal is submitted and shall be further disqualified from submitting any future bids or proposals for work or for goods or services for Manatee County.

The County anticipates that all statements made and materials submitted in a proposal will be truthful. If a bidder or proposer is determined to be untruthful in its proposal or any related presentation, such bidder or proposer may be disqualified from further consideration regarding this Invitation For Bid or Request for Proposal.

#### A.14 BID FORMS

Bids must be submitted on attached County forms, although additional pages may be attached. **Bidders must fully comply with all bid Contract Documents, terms, and conditions.** Failure to comply shall result in contract default, whereupon, the defaulting vendor shall be required to pay for any and all re-procurement costs, damages, and attorney fees as incurred by the County.

#### A.15 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 price used in determining award(s).

**A.16 TAXES**

Manatee County is exempt from Federal Excise and State Sales Taxes (F.E.T. Exempt Cert. No. 59-78-0089K and FL Sales Tax Exempt Cert. No. 51-02-027548-53C); 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.17 MATHEMATICAL ERRORS**

Bids submitted shall be based on the quantities stated on the Bid Form. Quantities shall be used for the comparison of Bids. Payment to the Contractor will be made based on the actual quantity of work completed and accepted at the date of payment request, in accordance with the terms of the contract.

In the event of multiplication/extension error(s), the unit price shall prevail. In the event of addition error(s), the extended totals shall prevail. All bids shall be reviewed mathematically and corrected, if necessary, using these standards prior to additional evaluation. Calculations shall be factored to the second decimal point.

**A.18 DESCRIPTIVE INFORMATION**

Unless otherwise specifically provided in the Contract Documents, all equipment, materials and articles incorporated in the work covered by this contract shall be new and of the most suitable grade for the purpose intended. Unless otherwise specifically provided in the Contract 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.19 PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES CERTIFICATION**

In accordance with Ordinance 08-43, adding Article 5, Manatee County Board of County Commissioners adopted a policy prohibiting the award of County contracts to persons, business entities, or affiliates of business entities who have not submitted written certification to the County that they have not been convicted of bribery, attempted bribery, collusion, restraints of trade, price fixing, and violations of certain environmental laws. A Non-Conviction Certification Form is attached for this purpose.

**A.20 DRUG FREE WORK PLACE**

The Manatee County Board of County Commissioners adopted a policy regarding Bidders maintaining a Drug Free Work Place, prohibiting the award of bids to any person or entity that has not submitted written certification to the County that it has complied with those requirements [Reference Resolution R-93-22, Manatee County Purchasing Policies, Section 4, E (1) (a)].

A Drug Free Work Place Certification Form is attached to this bid for this purpose.

**A.21. PUBLIC ENTITY CRIMES**

In accordance with Section 287.133, Florida Statutes, a person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases or real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017 for Category Two (as of 01/01/2005 is \$25,000) for a period of 36 months from the date of being placed on the convicted vendor list.

**A.22. MODIFICATION OF BID CONTRACT DOCUMENTS**

If a bidder wishes to recommend changes to the bid Contract Documents, the bidder shall furnish in writing, data and information necessary to aid the County in evaluating the request to modify the bid Contract Documents. The County is not obligated to make any changes to the bid Contract Documents. Unless an addendum is issued as outlined in Article A.04, the bid Contract Documents shall remain unaltered. **Bidders must fully comply with the bid Contract Documents, terms, and conditions.**

**A.23. AMERICAN DISABILITIES ACT**

The Board of County Commissioners of Manatee County, Florida, does not discriminate upon the basis of any individual's disability status. This non-discrimination policy involves every aspect of the 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 first page of this Bid Document at least twenty-four (24) hours in advance of either activity.

**A.24. LOBBYING**

After the issuance of any Invitation For Bid or Request For Proposal, prospective bidders, proposers or any agent, representative or person acting at the request of such bidder or proposer shall not contact, communicate with or discuss any matter relating in any way to the Invitation for Bids or Request for Proposals with any officer, agent or employee of Manatee County other than the Purchasing Director or as directed in the Invitation for Bids or Request for Proposals. This prohibition begins with the issuance of any Invitation for Bids, or Request for Proposals, and ends upon execution of the final contract or when the invitation or request has been cancelled. Violators of this prohibition shall be subject to sanctions as provided in the Manatee County Purchasing Code.

***The County reserves the right to amend or to add to the names listed as persons to contact. All amendments or additions to the names listed as persons to contact shall be issued by Purchasing, in writing.***

**A.25 EQUAL EMPLOYMENT OPPORTUNITY CLAUSE**

Manatee County, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 and the Regulations of the Department of Commerce (15 CFR, Part 8) issued pursuant to such Act, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, minority business enterprises will be afforded full opportunity to submit bids in response to this advertisement and will not be discriminated against on the grounds of race, color or national origin in consideration for an award.

**A.26 MBE/WBE**

The State of Florida, **Office of Supplier Diversity** provides the certification process and the database for identifying certified MBE/WBE 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.

**NOTE: ANY OR ALL STATEMENTS CONTAINED IN THE FOLLOWING SECTIONS; BASIS OF AWARD, TERMS AND CONDITIONS OF THE CONTRACT, OR CONTRACT DOCUMENTS WHICH VARY FROM THE INFORMATION TO BIDDERS SHALL HAVE PRECEDENCE.**



SECTION 00020  
**BASIS OF AWARD**

**B.01 BASIS OF AWARD**

Award shall be to the most responsive, responsible bidder meeting specifications and having the lowest Total Bid Price for **Bid "A"**, or the lowest Total Bid Price 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 Contract Documents to the County's satisfaction within the prescribed time.

**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 Bid Price". The County has the sole authority to select the bid based on the Completion Time which is in the best interest of the County. Only one award shall be made.**

In evaluating bids, the 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, quality and service, 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, quality and service are received, and both bids or neither of these bids are received from a local business, the award shall be determined by a chance drawing conducted by the Purchasing Office and open to the public.

Local business is defined as a business duly licensed and authorized to engage in the sale of goods and/or services to be procured, which has a place of business in Manatee County with full time employees at that location.

**B.02 QUALIFICATIONS OF BIDDERS**

Each bidder must secure all licenses required (in accordance with Chapter 489 Florida Statutes) for the Work which is the subject of this bid; and, upon request, shall submit a true copy of all applicable licenses. The minimum license requirement for this project is a **Florida General Contractor's License.**

To demonstrate qualifications to perform the Work, each bidder must be prepared to submit within five days of County's request; written evidence such as financial data, previous experience, present commitments and other such data as may be requested. Bidder must be able to provide evidence of Bidder's qualification to do business in the state of Florida. Each bidder shall submit as a portion of their bid a completed Contractor's Questionnaire included as Section 00430.

**B.02 QUALIFICATIONS OF BIDDERS (Continued)**

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

**B.03 PREPARATION OF CONTRACT**

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 Agreement. Within 10 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement with any other required documents to County. (Note: Contract must be approved and executed by Manatee County Board of County Commissioners to be valid.)

**B.04 INSPECTION OF SITE**

Inspection of Site shall be a requirement to be considered for award of this bid. For coordination of Site Inspection, bidders shall contact the Owner's Representative, Mr. Jim Marble, Lift Station Superintendent at 941-755-1953, Extension 5277.

**Site Visitation immediately following Information Conference, January 30, 2009.**

SECTION 00030  
**GENERAL TERMS AND CONDITIONS OF THE CONTRACT**

**C.01 CONTRACT FORMS**

The agreement resulting from the acceptance of a bid shall be in the form of the agreement stated in this bid.

**C.02 ASSIGNMENT OF CONTRACT**

Contractor shall not assign, transfer, convey, sublet or otherwise dispose of this 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 the 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.

**C.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 based on **320 calendar days** and based on **365 calendar days**. The County has the sole authority to select the bid based on the Completion Time which is in the best interest of the County. Only one award shall be made.

**C.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, the County may seek damages. The actual damages for delay will be impossible to determine and in lieu thereof, the Contractor shall pay to the Owner the sum of **\$1,423.00** as fixed, agreed, and liquidated damages for each calendar day of the delay until the Work is finally accepted by the County and the Contractor and his Surety shall be liable for the amount thereof.

**C.05 PAYMENT**

Contractor may apply for partial payment on monthly estimates, based on the amount of Work done or completed in compliance with the provisions of the Contract. Contractor shall submit an application, on a form provided or approved by the 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. The County will then review said estimate and make any necessary revisions so that the estimate can receive approval for payment. If the Contractor and the County do not agree on the approximate estimate of the proportionate value of the Work done for any pay period, the determination of the 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 within 20 days after the pay estimate has been approved by the County. 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.

**C.05 PAYMENT (Continued)**

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 the 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 the 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 the County in writing that the project is ready for final inspection. The 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 the County determines the project or portion thereof is ready for final inspection, the County shall perform same. Upon completion of final inspection, the 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 the County, the project has been completed in compliance with the terms of the Contract Documents.

When final acceptance has been made by the County, the County will make final payment of the Contract amount, plus all approved additions, less approved deductions and previous payments made. The 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 the County. The Contractor's responsibility shall then terminate except as otherwise stated.

**C.06 RETAINAGE**

A **retainage** of 2.5% of the total contract amount shall be withheld from payments after 75% completion of the Work. Upon substantial completion, this retainage shall be reduced to 1% of the total contract amount plus such amount as the Owner may reasonably deem necessary to repair, replace, complete or correct any damaged, defective, incorrect or incomplete work. Upon final acceptance, the remaining retainage shall be included in the final payment.

**C.07 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 the Owner 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 be such as to meet the required standards and to accomplish the purposes and functions required standards and to accomplish the purposes and functions of the project as defined, detailed, and specified herein.

The Owner 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 the Owner as to any claims or actions for breach of guaranty or breach of warranty that the Owner might have against parties other than the contractor, and do not constitute exclusive remedies of the Owner against the contractor.

**C.8 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 the County harmless from loss on account thereof, including costs and attorney's fees.

**C.9 AUTHORIZED PRODUCT REPRESENTATION**

The contractor, 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 the County's sole discretion, be deemed a breach of contract, and shall constitute grounds for the County's immediate termination of the contract.

**C.10 REGULATIONS**

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

**C.11 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 contract, the 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 contract, the County reserves the right to terminate the contract and select the next qualified bidder or re-advertise this procurement in part or in whole. The County reserves the right to cancel all or any undelivered or unexecuted portion of this contract with or without cause.

**C.12 INDEMNIFICATION**

The contractor covenants and agrees to indemnify and save harmless the 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 agreement 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 the 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 award, resulting agreement, contract or Purchase Order shall be deemed to affect the rights, privileges and immunities of the County as set forth in Florida Statute Section 768.28.

**C.13 MANUALS, SCHEMATICS, HANDBOOKS**

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 bidder. Vendor shall furnish two (2) copies of each.

**C.14 INSURANCE**

The contractor will not commence work under a contract until all insurance under this section and such insurance coverage as might be required by the County has been obtained. The contractor shall obtain, and submit to Purchasing within 10 calendar days of request, 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 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 contract documents which are customarily insured under Part Two of the standard Workers' Compensation Policy shall be:

<u>\$100,000</u>	(Each Accident)
<u>\$500,000</u>	(Disease-Policy Limit)
<u>\$100,000</u>	(Disease-Each Employee)

b. **Commercial General Liability**

The limits are to be applicable only to work performed under this 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) to

C.14 INSURANCE (Continued)

a Commercial General Liability Policy with the following minimum limits.

General Aggregate:

Products/Completed Operations Aggregate	<u>\$1,000,000</u>
Personal and Advertising Injury	<u>\$300,000</u>
Each Occurrence	<u>\$300,000</u>
Fire Damage (Any one Fire)	<u>\$Nil</u>
Medical Expense (Any One Person)	<u>\$Nil</u>

c. Business Auto Policy

Each Occurrence Bodily Injury and Property Damage Liability Combined	<u>\$300,000</u>
Annual Aggregate (if applicable):	<u>\$1,000,000</u>

d. Owners Protective Liability Coverage

The minimum OPC Policy limits per occurrence and, if subject to an aggregate, annual aggregate to be provided by the contractor shall be the same as the amounts shown above as the minimum per occurrence and general policy aggregate limits respectively required for the Commercial General Liability coverage. The limits afforded by the OPC Policy and any excess policies shall apply only to the Owner and the Owner's officials, officers, agents and employees and only to claims arising out of or in connection with the work under this contract.

e. Property Insurance

**If this 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).

f. Installation Floater

**If this 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).

g. Certificates of Insurance and Copies of Policies

Certificates of Insurance in triplicate evidencing the insurance coverage specified in the six above paragraphs a., b., c., d., e. and f., shall be filed with the Purchasing Director 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, project title and location of project. Insurance shall remain in force at least one year after completion and acceptance of the project by the County, in the amounts and types as stated herein, with coverage for all products and services completed under this contract.

**C.14 INSURANCE (Continued)**

**ADDITIONAL INSURED:** The contractor shall name Manatee County as additional insured in each of the applicable policies.

If the initial insurance expires prior to the completion of operations and/or services by the contractor, renewal certificates of insurance and required copies of policies shall be furnished by the contractor and delivered to the Purchasing Director 30 (thirty) days prior to the date of their expiration.

Nothing herein shall in any manner create any liability of the 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 the County or to any workers, suppliers, material men or employees in relation to this contract.

**C.15 BID BOND/CERTIFIED CHECK**

By offering a submission 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 10 days after being notified of the awarding of the contract. The bidder further agrees that failure to execute and deliver said form of contract **within 10 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 the County enters into a contract with a bidder, or if the County rejects any and/or all bids, accompanying bond will be promptly returned.

**C.16 PERFORMANCE AND PAYMENT BONDS**

The successful bidder shall furnish surety bonds 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. Surety of such bonds shall be in an amount equal to the bid award (100% each) and from a duly authorized and nationally recognized surety company, authorized to do business in Florida, satisfactory to this County. The attorney-in-fact who signs the bonds must file with the bonds a certificate and effective dated copy of power-of-attorney. (Reference Florida Statute 255.05)

Furnishing the performance and payment bonds shall be requisite to execution of a contract with the 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 successful bidder to execute such contract and to supply the required bonds shall be just cause for annulment of the award.

The County may then contract with another acceptable bidder or re-advertise this Invitation For Bid. If another bidder is accepted, and notice given within 90 days after the opening of bids, this acceptance shall bind the bidder as though they were originally the successful bidder.



**C.16 PERFORMANCE AND PAYMENT BONDS (Continued)**

Failure of the County at any time, to require performance by the contractor of any provisions set out in the contract will in no way affect the right of the County, thereafter, to enforce the provisions. Bonds to remain in effect for one year after final payment becomes due.

**C.17 PROJECT SCHEDULE**

The successful bidder will be required to submit a detailed construction schedule upon notification of award or its intent.

**C.18 NO DAMAGES FOR DELAY**

No claim for damages or any claim other than for an extension of time shall be made or asserted against the 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 the 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 the 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 extend specifically provided above.

**C.19 NO INTEREST**

Any monies not paid by the 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 the 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.

**C.20 CONSTRUCTION OF CONTRACT**

This 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.

SECTION 00100  
**INSTRUCTIONS TO BIDDERS**

**D.01 THE WORK**

The work included in this contract consists of various improvements at the Tara #20 Master Lift Station (MLS). The following work will be performed at the lift station: installation of New pumps, level sensor, flow meter, and pressure transducer; replacement of existing PVC piping with stainless steel piping and replacement of the discharge valves in the valve vault; installation of a new gantry hoist system; installation of a new emergency generator including a fuel tank and sound attenuated enclosure; reworking of the lighting in the pump station area; installation of a new electrical building with new electrical service, main circuit breaker, transformer, power distribution panel boards, generator automatic transfer switch, variable frequency drives, lighting, air conditioning, and an Owner provided / Contractor installed Control Cabinet to control the pumps and drives and provide monitoring signals to the SCADA system; and bypass pumping, as necessary, to perform the work.

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. 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 Owner. 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.

**LOCATION OF WORK:** 7211 Stone River Road  
Bradenton, FL

**D.02 SECURING OF DOCUMENTS**

Complete individual copies of the bidding documents for the project and/or products can be obtained at the Manatee County Public Works Department located at: 1022 26<sup>th</sup> Avenue East, Bradenton, FL 34208: 941-708-7450, Extension 7349 between the hours of 8:00 AM and 4:00 PM Monday through Friday at no charge. Complete set of the Bidding Documents must be used in preparing bids. Neither Owner nor Engineer assumes any responsibility for errors and misinterpretations resulting from the use of incomplete sets of Bidding Documents.

**D.03 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 the Owner for each bid item from any of the Bidders; and the Bidder shall respond within five 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 Owner. If Owner, after due investigation, has reasonable objection to any proposed subcontractor, supplier, other person or organization, Owner may, before the

**D.03 SUBCONTRACTORS, SUPPLIERS AND OTHERS (Continued)**

Notice of 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, Owner may award the contract to the next lowest qualified Bidder that proposes to use acceptable subcontractors, suppliers, and other persons who Owner 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 this contract insofar as it applies to their Work, but this shall not relieve the prime contractor from the full responsibility to the Owner for the proper completion of all Work to be executed under this contract.

**No more than 45% of the Total Bid Price, including labor and materials, but excluding Discretionary Work, shall be performed by subcontractors.**

Bid Form includes a duplication of the bid items where the Bidder shall state the percentage of work and a description of the work (of each item) which shall be performed by a subcontractor.

**D.04 BIDS**

Bids are to be submitted in triplicate, one original and two copies, upon the County supplied forms. 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.

**D.05 EXAMINATION OF CONTRACT DOCUMENTS AND SITE**

It is the responsibility of each Bidder before submitting a Bid, to (a) examine the Bid Documents thoroughly; (b) visit the site 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 Owner of all conflicts, errors, or discrepancies in the Bid Document. The accuracy of the existing utility locations shown on the plans is approximate and without express or implied warranty. Each Bidder may, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies,

**D.05 EXAMINATION OF CONTRACT DOCUMENTS AND SITE (Continued)**

and obtain any additional information and data which pertain to the physical conditions at or contiguous to the site 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 Contract Documents.

Owner will provide each Bidder access to the site to conduct such explorations and tests. Bidder shall fill all holes, clean up and restore the site 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 Contract 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 Owner unless otherwise provided in the Contract Documents.

**NOTE: Questions received six calendar days or less from the date of the bid opening may not be answered.**

## SECTION 00300

**BID FORM**  
**(SUBMIT IN TRIPLICATE)**

For: Improvements to the Tara #20 Master Lift Station (Project No. 6022087):

TOTAL BID PRICE "A": \$ \_\_\_\_\_ Based on a Completion Time of 320 Calendar Days

TOTAL BID PRICE "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 Bid Price". The County has the sole authority to select the bid based on the Completion Time which is in the best interest of the 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 Bids.

We understand that the bid technical specifications, terms, and conditions in their entirety shall be made a part of any agreement or 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 the County.

Communications concerning this Bid shall be addressed as follows:

Person's Name: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

Date: \_\_\_\_\_ FL Contractor License# \_\_\_\_\_

Bidder is a WBE/MBE Vendor? \_\_\_\_\_ Certification # \_\_\_\_\_

COMPANY NAME: \_\_\_\_\_

AUTHORIZED SIGNATURE(S): \_\_\_\_\_

\_\_\_\_\_  
Name and Title of Above Signer(s)

CO. MAILING ADDRESS: \_\_\_\_\_

STATE OF INCORPORATION: \_\_\_\_\_ (if applicable)

TELEPHONE: (\_\_\_\_) \_\_\_\_\_ FAX: (\_\_\_\_) \_\_\_\_\_

Acknowledge Addendum Nos. \_\_\_\_\_ Dated: \_\_\_\_\_ Acknowledge Addendum Nos. \_\_\_\_\_ Dated: \_\_\_\_\_

**ACKNOWLEDGE SITE VISIT: (Name): \_\_\_\_\_ DATE: \_\_\_\_\_**

**BID FORM**

(Submit in Triplicate)

Section 00300

**(BID "A")****Improvements at the Tara #20 Master Lift Station - Based on  
Completion Time of 320 Calendar Day**

ITEM	DESCRIPTION	U/M	EST. QTY.	UNIT PRICE	EXTENDED PRICE
1	Mobilization	LS	1		
2	Civil / Mechanical / Structural / Electrical Instrumentation Work	LS	1		
3	Miscellaneous Work and Cleanup	LS	1		
4	Discretionary Work				\$100,000.00
<b>TOTAL BID PRICE - Based on Completion Time of <u>320</u>calendar days</b>					<b>\$</b>

BIDDER: \_\_\_\_\_

00300-2

**BID FORM - SUBCONTRACTOR PERCENTAGE**(Submit in Triplicate)  
SECTION 00300**(BID "A")****Improvements at the Tara #20 Master Lift Station - Based on  
Completion Time of 320 Calendar Days**

ITEM NO.	DESCRIPTION	SUBCONTRACTOR		DESCRIPTION OF WORK BY SUBCONTRACTOR
		%	MBE/WBE	
1	Mobilization			
2	Civil / Mechanical / Structural / Electrical Instrumentation Work			
3	Miscellaneous Work & CleanUp			

This is a duplication of the bid items where the Bidder shall state the percentage of work (of each item listed) and a description of the work which shall be performed by a subcontractor.

BIDDER: \_\_\_\_\_

**BID FORM**  
 (Submit in Triplicate)  
 Section 00300

**(BID "B")**

**Improvements at the Tara #20 Master Lift Station - Based on  
 Completion Time of 365 Calendar Days**

ITEM	DESCRIPTION	U/M	EST. QTY.	UNIT PRICE	EXTENDED PRICE
1	Mobilization	LS	1		
2	Civil / Mechanical / Structural / Electrical Instrumentation Work	LS	1		
3	Miscellaneous Work and Cleanup	LS	1		
4	Discretionary Funds				\$100,000.00
<b>TOTAL BID PRICE - Based on Completion Time of <u>365</u> calendar days</b>					\$

BIDDER: \_\_\_\_\_



**BID FORM - SUBCONTRACTOR PERCENTAGE**

(Submit in Triplicate)

SECTION 00300

**(BID "B")****Improvements at the Tara #20 Master Lift Station - Based on Completion  
Time of 365 Calendar Days**

ITEM NO.	DESCRIPTION	SUBCONTRACTOR		DESCRIPTION OF WORK BY SUBCONTRACTOR
		%	MBE/WBE	
1	Mobilization			
2	Civil / Mechanical / Structural / Electrical Instrumentation Work			
3	Miscellaneous Work & CleanUp			

This is a duplication of the bid items where the Bidder shall state the percentage of work (or each item listed) and a description of the work which shall be performed by a subcontractor.

BIDDER: \_\_\_\_\_

**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. #09-0670-OV
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 the Owner 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: \_\_\_\_\_

SECTION 00430  
**CONTRACTOR'S QUESTIONNAIRE**  
(Submit in Triplicate)

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

**THIS QUESTIONNAIRE MUST BE COMPLETED AND SUBMITTED WITH YOUR BID.**

1. LICENSE # and COMPANY'S NAME: \_\_\_\_\_  
 CO. PHYSICAL ADDRESS: \_\_\_\_\_  
 TELEPHONE NUMBER: ( ) \_\_\_\_\_ FAX: ( ) \_\_\_\_\_
  
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 venturers and the same if any venturer is a corporation for each such corporation, partnership, or joint venture:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
  
4. Your organization has been in business (under this firm's name) as a \_\_\_\_\_ for how many years? \_\_\_\_\_
  
5. Describe and give the date and owner of the last three government projects you've completed which are similar in cost, type, size, and nature as the one proposed (for a public entity). Include contact name and phone number:  
 \_\_\_\_\_  
 \_\_\_\_\_
  
6. 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.  
 \_\_\_\_\_  
 \_\_\_\_\_
  
7. Have you ever failed to complete work awarded to you? If so, state when, where (contact name, address, phone number) and why?  
 \_\_\_\_\_  
 \_\_\_\_\_

8. Have you ever been debarred or prohibited from bidding on a governmental entity's construction project? If yes, name the entity and describe the circumstances:

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9. Name three individuals, governmental entities, or corporations for which you have performed similar work and to which you refer. Include contact name and phone number:

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

10. What specific steps have you taken to examine the physical conditions at or contiguous to the site, including but not limited to, the location of existing underground facilities?

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11. What specific physical conditions, including, but not limited to, the location of existing underground facilities have you found which will, in any manner, affect cost, progress, performance, or finishing of the work?

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

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13. If any, list (with contract amount) WBE/MBE to be utilized:

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14. What equipment do you own to accomplish this Work?

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15. What equipment will you purchase/rent for the Work? (specify which)

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16. List the following in connection with the Surety which is providing the Bond(s):

Surety's Name: \_\_\_\_\_

Surety's Address: \_\_\_\_\_

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

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Phone: (      ) \_\_\_\_\_

**SECTION 00491**  
**Drug Free Work Place Certification**  
 SWORN STATEMENT PURSUANT TO RESOLUTION R-93-22  
 DRUG FREE WORK PLACES

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 agreement, or shall receive a grant of county monies unless such person or entity has submitted a written certification to the County that it will provide a drug free work place by:

(1) providing a written statement to each employee notifying such employee that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance as defined by 893.02(4), Florida Statutes, as the same may be amended from time to time, in the person's or entity's work place is prohibited specifying the actions that will be taken against employees for violation of such prohibition. Such written statement shall inform employees about:

- (i) the dangers of drug abuse in the work place;
- (ii) the person's or entity's policy of maintaining a drug free environment at all its work places, including but not limited to all locations where employees perform any task relating to any portion of such contract, business transaction or grant;
- (iii) any available drug counseling, rehabilitation, and employee assistance programs; and
- (iv) the penalties that may be imposed upon employees for drug abuse violations.

(2) Requiring the employee to sign a copy of such written statement to acknowledge his or her receipt of same and advice as to the specifics of such policy. Such person or entity shall retain the statements signed by its employees. Such person or entity shall also post in a prominent place at all of its work places a written statement of its policy containing the foregoing elements (i) through (iv).

(3) Notifying the employee in the statement required by subsection (1) that as a condition of employment the employee will:

- (i) abide by the terms of the statement; and
- (ii) notify the employer of any criminal drug statute conviction for a violation occurring in the work place no later than five (5) days after such a conviction.

(4) Notifying the County within ten (10) days after receiving notice under subsection (3) from an employee or otherwise receiving actual notice of such conviction.

(5) Imposing appropriate personnel action against such employee up to and including termination; or requiring such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a federal, state, or local health, law enforcement, or other appropriate agency.

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

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE 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 THE COUNTY ADMINISTRATOR DETERMINES THAT:

- (1) Such person or entity has made false certification.
- (2) Such person or entity violates such certification by failing to carry out the requirements of sections (1), (2), (3), (4), (5), or (6) or Resolution R-01-36 Section 4, E (1) (a) or
- (3) Such a number of employees of such person or entity have been convicted of violations occurring in the work place as to indicate that such person or entity has failed to make a good faith effort to provide a drug free work place as required by Resolution R-01-36 Section 4, E (1) (a).

\_\_\_\_\_  
[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]

\_\_\_\_\_  
Notary Public Signature My commission expires \_\_\_\_\_

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

**PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES CERTIFICATION**

**SWORN STATEMENT PURSUANT TO ARTICLE 5,  
MANATEE COUNTY PURCHASING CODE**

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 agreement, or shall receive a grant of county monies unless such person or entity has submitted a written certification to the 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 the County's Purchasing Director, reflects negatively upon the ability of the person or entity to conduct business in a responsible manner; or

(4) made an admission of guilt of such conduct described in items (1), (2) or (3) above, which is a matter of record, but has not been prosecuted for such conduct, or has made an admission of guilt of such conduct, which is a matter of record, pursuant to formal prosecution. An admission of guilt shall be construed to include a plea of nolo contendere; or

(5) where an officer, official, agent or employee of a business entity has been convicted of or has admitted guilt to any of the crimes set forth above on behalf of such and entity and pursuant to the direction or authorization of an official thereof (including the person committing the offense, if he is an official of the business entity), the business shall be chargeable with the conduct herein above set forth. A business entity shall be chargeable with the conduct of an affiliated entity, whether wholly owned, partially owned, or one which has common ownership or a common Board of Directors. For purposes of this Form, business entities are affiliated if, directly or indirectly, one business entity controls or has the power to control another business entity, or if an individual or group of individuals controls or has the power to control both entities. Indicia of control shall include, without limitation, interlocking management or ownership, identity of interests among family members, shared organization of a business entity following the ineligibility of a business entity under this Article, or using substantially the same management, ownership or principles as the ineligible entity.

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

\_\_\_\_\_  
Notary Public Signature My commission expires \_\_\_\_\_

\_\_\_\_\_  
[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.

SECTION 00500  
**FORM OF AGREEMENT  
 BETWEEN THE  
 COUNTY OF MANATEE, FLORIDA  
 AND THE CONTRACTOR AS IDENTIFIED BELOW  
 ON THE BASIS OF A STIPULATED UNIT COST CONTRACT PRICE**

THIS AGREEMENT is made and entered into by and between the COUNTY OF MANATEE, a political subdivision of the state of Florida, hereinafter referred to as the "OWNER" and \_\_\_\_\_, hereinafter referred to as the "CONTRACTOR," duly authorized to transact business in the state of Florida, with offices located at \_\_\_\_\_.

**Article 1. WORK**

CONTRACTOR shall furnish all labor, materials, supplies, and other items required to complete the Work for IFB No. **IFB#09-0670-OV, Improvements to the Tara #20 Master Lift Station, Bradenton, FL** in accordance with Contract Documents and any duly authorized subsequent addenda thereto, all of which are made a part hereof.

**Article 2. ENGINEER**

The County of Manatee, Project Management Department, is responsible as the OWNER and \_\_\_\_\_ hereinafter referred to as "ENGINEER," designed this project and is responsible for technical/engineering reviews and decisions. The ENGINEER is a member of the OWNER'S project management team which is collectively responsible in ensuring the Work is completed in accordance with the Contract Documents. All communications involving this project will be addressed to:

County of Manatee, Public Works Department  
 Project Management Division  
 Attn: Chuck Froman, Project Manager  
 IFB 09-0670-OV / Project No. 6022087  
 1022 26<sup>th</sup> Avenue East  
 Bradenton, Florida 34208  
 Phone: 941-708-7450 – Ext. 7333

URS Corporation  
 7650 West Courtney Campbell  
 Attn: Craig P. Osmanski, P.E.  
 Suite 700  
 Tampa, Florida 33607  
 Phone: 813-286-6587

Where the terms ENGINEER and/or OWNER are used in the Contract Documents, it shall mean the OWNER'S project management team.

**Article 3. CONTRACTOR'S REPRESENTATIONS**

In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations:

- 3.1 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.
- 3.2 CONTRACTOR has studied carefully all drawings of the physical conditions upon which CONTRACTOR is entitled to rely.
- 3.3 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.
- 3.4 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 the CONTRACTOR will be done at the CONTRACTOR'S expense.
- 3.5 CONTRACTOR has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Bid.
- 3.6 CONTRACTOR has given OWNER written notice of all conflicts, errors or discrepancies that have been discovered in the Bid Documents and the written resolution thereof by OWNER is acceptable to CONTRACTOR.

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

#### **Article 4. CONTRACT DOCUMENTS**

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

- 4.1 This Agreement and Bid Document IFB#09-0670-OV
- 4.2 Performance and/or other Bonds and Insurance Certificate(s)
- 4.3 Drawings (not attached)
- 4.4 Addenda numbers \_\_\_\_ to \_\_\_\_, inclusive.
- 4.5 CONTRACTOR'S Bid Form and any other information submitted by Contractor prior to Notice of Award.
- 4.6 The following which may be delivered or issued after the effective date of the Agreement and are not attached hereto: all written Change Orders and other documents amending, modifying, or supplementing the Contract Documents.
- 4.7 The documents listed in paragraphs above are attached to this Agreement (except as noted otherwise above). There are no Contract Documents other than those listed above in this Article 4.

#### **Article 5. MISCELLANEOUS**

- 5.1 Terms used in this Agreement are defined in Article 1 of the General Conditions.
- 5.2 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.

5.3 OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.

The OWNER will pay, and the CONTRACTOR will accept in full consideration for the performance of the Work (IFB No. #09-0670-OV Improvements to the Tara #20at Master Lift Station) subject to additions and deductions as provided therein, the sum of Dollars and \_\_\_\_\_ Cents (\$ \_\_\_\_\_) for Bid "\_\_\_\_" based on Completion Time of \_\_\_\_ calendar days and the sum of \$1,423.00 as liquidated damages for each calendar day of delay.

\_\_\_\_\_  
CONTRACTOR

BY: \_\_\_\_\_  
Signature

\_\_\_\_\_  
Type Name and Title of Signer

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_, 2008, by \_\_\_\_\_, who is personally known to me or who has produced \_\_\_\_\_ as identification.

(impress official seal)

\_\_\_\_\_  
Notary Public, State of Florida

My commission expires: \_\_\_\_\_

APPROVED, with a quorum present and voting this \_\_\_\_ day of \_\_\_\_\_, 2008.

ATTEST: R.B. SHORE  
Clerk of the Circuit Court

COUNTY OF MANATEE, FLORIDA by its  
Board of County Commissioners

\_\_\_\_\_  
BY: \_\_\_\_\_  
CHAIRMAN

# APPLICATION FOR PAYMENT

Project: \_\_\_\_\_  
 From: \_\_\_\_\_ To: \_\_\_\_\_

Request No. \_\_\_\_\_ Project No. \_\_\_\_\_  
 Purchase Order Number: \_\_\_\_\_  
 County Bid No.: \_\_\_\_\_  
 Consultant: \_\_\_\_\_

## CONTRACT PAYMENT SUMMARY

Original contract amount:		\$
Change order(s):		
Change order summary:		
Number	Date Approved	Additive
		Deductive
SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER		
SUBTOTALS:		
Net change order subtotal (Additive less Deductive):		\$
Current Contract Amount (CCA): (Original Amount + Change Order(s))		\$
	Previous Status	Current Status
Value of the Work in Place	\$	\$
Value of Stored Materials	\$	\$
Total Earned (\$ and % of CCA)	\$	\$ %
Retainage (\$ and % of CCA)	\$	\$ %
Net Earned (Total earned minus retainage)		\$
TOTAL PREVIOUS PAYMENTS		\$
AMOUNT DUE THIS PAYMENT (Net Earned minus Previous Payments)		\$

## CONTRACTOR'S AFFIDAVIT OF NOTICE

CERTIFICATE: The undersigned CONTRACTOR certifies that all items and amounts shown on this application for payment are on account of work performed, materials supplied and/or materials stored on site and paid for by Contractor in accordance with the Contract Documents with due consideration for previous Payment(s), if any, received by the Contractor from the County, and that the current payment shown is now due.

NOTARY: \_\_\_\_\_ CONTRACTOR: \_\_\_\_\_

State of Florida County of \_\_\_\_\_ Signature: \_\_\_\_\_  
 Name of person authorized to sign Affidavit of Notice

Sworn to (or affirmed) and subscribed before me  
 this \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_ by \_\_\_\_\_  
 \_\_\_\_\_  
 (Name of person giving notice) Contractor name, address and telephone No.:

\_\_\_\_\_  
 (Signature of Notary Public - State of Florida)  
 Print, Type or Stamp Commissioned Name  
 of Notary Public: \_\_\_\_\_

Personally Known \_\_\_\_\_ or Produced Identification \_\_\_\_\_  
 Type of Identification Produced: \_\_\_\_\_

## VERIFICATION, RECOMMENDATION, CONCURRENCES AND APPROVALS

(Signatures) (Date)

Quantities verified by: \_\_\_\_\_

Consultant / Engineer: \_\_\_\_\_

Project Manager: \_\_\_\_\_

Department Head: \_\_\_\_\_

Payment Approved by the  
 Board of County Commissioners: \_\_\_\_\_

Attested to by the Clerk of Circuit Court: \_\_\_\_\_

## PAY APPLICATION SCHEDULE (CONTINUATION SHEET)

PAGE \_\_\_ OF \_\_\_ PAGES.

ITEM NO.	DESCRIPTION OF WORK	UNIT PRICE		QTY	VALUE	CHANGE ORDERS			PREVIOUS W.I.P.			CURRENT W.I.P.			TOTAL W.I.P. %				
		C	D			#	G	H	I	J	K	L	M	N		O	P		
																		QTY	+/-
A																			
SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER																			
<b>TOTALS</b>																			
ATTACH STORED-MATERIAL SCHEDULE																			

MANATEE COUNTY  
PROJECT MANAGEMENT FORM PMD-2

NOTE: CONTRACTOR MAY SUBMIT A COMPUTER SPREADSHEET IN LIEU OF FILLING IN THIS FORM IF THE SAME INFORMATION IS PROVIDED.  
00550-2

MARCH 19, 1999

### PAY APPLICATION SCHEDULE OF STORED MATERIALS

ITEM NO. A	DESCRIPTION OF MATERIALS B	SUPPLIER C	PAID INVOICE D	PREVIOUSLY RECEIVED E	RECEIVED THIS PERIOD F	PREVIOUSLY INSTALLED G	INSTALLED THIS PERIOD H	BALANCE TO INSTALL I	VALUE OF BALANCE J
	SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER								
<b>TOTAL</b>									

MANATEE COUNTY  
 PROJECT MANAGEMENT FORM PMD-3  
\*F:\USER\PM\W\57122000\SP\MGT\FORMS\PMD3.1.T2\*

NOTE: CONTRACTOR MAY USE A COMPUTER SPREADSHEET IN LIEU OF FILLING IN THIS FORM IF SAME INFORMATION IS PROVIDED.  
 00550-3

MARCH 19, 2000



<b>CONTRACT CHANGE ORDER</b>		Change Order No.:	
		Contract Amount: (Present Value)	
		Project Number:	
PROJECT:			
NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
	SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER		
		TOTAL DECREASE:	TOTAL INCREASE:
Contractor: Address: City / State:		THE NET CHANGE ADJUSTS THE CURRENT CONTRACT AMOUNT FROM TO	
Contractor Signature: _____		_____ CALENDAR DAYS ARE ADDED TO THE SCHEDULE WHICH CHANGES FINAL COMPLETION TO _____.	
<b>RECOMMENDATION, CONCURRENCES AND APPROVALS</b>			
SIGNATURES		DATE	
Consultant (as applicable): _____		_____	
Project Engineer: _____		_____	
Project Manager: _____		_____	
Department Head: _____		_____	
Approved by the Manatee County Board of County Commissioners: _____		_____	
Chairman			
Clerk of the Circuit Court: _____		_____	

**CONTRACT CHANGE ORDER**

Page 2 (Continuation)

Change Order No:

Project Number:

NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
	<p>SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER</p>		
		DECREASE SUBTOTAL:	INCREASE SUBTOTAL:

**CONTRACT CHANGE ORDER**

Page 3 (Continuation)

Change Order No:

Project Number:

NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
	<p>SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER</p>		
		DECREASE SUBTOTAL:	INCREASE SUBTOTAL:

**JUSTIFICATION FOR CHANGE**

Change Order No :

Project Number:

1. NECESSITY FOR CHANGE:

SAMPLE SHEET ONLY  
OBTAIN CURRENT VERSION OF FORM  
FROM PROJECT MANAGER

2. Is change an alternate bid? (yes / no)

3. Does change substantially alter the physical size of the project? (yes / no)  
(If yes, explain)

4. Effect of this change on other "Prime" contractors?

5. Has the Surety and insurance company been notified, if applicable?

<b>DISCRETIONARY WORK - FIELD DIRECTIVE</b>  <b>PROJECT:</b>	<b>FIELD DIRECTIVE NO:</b>
	<b>PROJECT NO.:</b>

ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE
	SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER	

	<b>DECREASE</b>
--	-----------------

<b>CONTRACTOR:</b> _____ <b>ADDRESS:</b> _____ <b>CITY/STATE:</b> _____  <b>CONTRACTOR SIGNATURE:</b> _____	THE DISCRETIONARY WORK AMOUNT IS DECREASED \$      FROM \$      TO \$      WITH NO CHANGE TO THE TOTAL CONTRACT AMOUNT.  TIME CAN ONLY BE ADDED BY CHANGE ORDER
---	--

**RECOMMENDATION, CONCURRENCES AND APPROVALS**

SIGNATURES	DATE
<b>CONSULTANT:</b> _____	_____
<b>PROJECT ENGINEER:</b> _____	_____
<b>PROJECT MANAGER:</b> _____	_____
<b>SENIOR PROJECT MANAGER:</b> _____	_____

<b>CERTIFICATE OF SUBSTANTIAL COMPLETION (S.C.)</b>	<b>CHECK ONE:</b>	
	Partial:	Total:
Project Title:	Date Submitted:	
Contractor Data: Name: Address: City/State/zip:	Project No.:	
	S.C. Date (Proposed)	
<p>If the "Partial" completion box above is checked, the following description applies to the work for which substantial completion is being sought. Otherwise, the work described in the Contract including approved changes, if any, is certified to be substantially complete: (Description of the portion of work substantially completed):</p> <p style="text-align: center;">SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER</p> <p style="text-align: center;">(USE CONTINUATION SHEETS IF NECESSARY)</p>		
<p>A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item does not alter the Contractor's responsibility to complete all of the contract work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by the Contractor within _____ days of substantial completion. The approved substantial completion date is: _____.</p> <p>_____ / Date                      _____ / Date Contractor Signature                      Engineer's Approval</p> <p>_____    _____ Printed Name and Title                      Printed Name and Title</p>		
<p>The Contractor shall be responsible for security, operation, safety, maintenance, HVAC, insurance and warranties in accordance with the Contract. The County will assume the responsibility for paying the cost of electrical power from midnight of the date of Engineer's approval as indicated above.</p> <p>ATTACH THE INSPECTOR'S FINAL WALKTHROUGH LIST OF DEFICIENCIES.</p>		

**FINAL RECONCILIATION, WARRANTY PERIOD DECLARATION  
AND CONTRACTOR'S AFFIDAVIT**

Project Title:	Date Submitted:
Contractor Data: Name: SAMPLE SHEET ONLY Address: OBTAIN CURRENT VERSION OF FORM City/State/zip: FROM PROJECT MANAGER	Project No.: Warranty (months):

This Final Reconciliation is for the work performed for Manatee County by the above named Contractor, hereinafter called CONTRACTOR, pursuant to a contract dated \_\_\_\_\_, as amended, and acts as an addendum thereto.

It is agreed that all quantities and prices in the attached Final Pay Estimate No. \_\_\_\_\_ are correct, that the amount of \$ \_\_\_\_\_, including retainage, is due to the CONTRACTOR, that no claims are outstanding as between the parties, and that the above stated sum represents the entirety of monies owed the CONTRACTOR.

It is further agreed that the warranty period for CONTRACTOR'S work pursuant to the Contract is from \_\_\_\_\_ to \_\_\_\_\_.

As (title) \_\_\_\_\_ for CONTRACTOR, I have authority to bind said CONTRACTOR, and as such make this final reconciliation, declaration and affidavit for the purpose of inducing Manatee County to make final payment to CONTRACTOR for work done at / upon \_\_\_\_\_ under said contract:

CONTRACTOR has paid all social security and withholding taxes accrued in connection with this construction project.

CONTRACTOR has paid all workers' compensation and other insurance premiums incurred in connection with this construction project.

CONTRACTOR has paid for all required permits in connection with this construction project.

All laborers, materialmen, suppliers, subcontractors and service professionals who worked for and/or supplied materials, equipment and/or services to the CONTRACTOR under this construction contract have been paid in full.

\_\_\_\_\_  
(Affiant Signature)

NOTARY:  
State of Florida County of \_\_\_\_\_, Sworn to (or affirmed) and subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, by \_\_\_\_\_ (person giving notice).

Signature of Notary Public - State of Florida: \_\_\_\_\_  
Print, Type or Stamp Commissioned Name of Notary Public:

Personally known \_\_\_\_\_ or produced identification \_\_\_\_\_  
Type of Identification Produced:

<b>ADMINISTRATIVE CONTRACT ADJUSTMENT</b>		Contract Adj. No.:	
		Contract Amount: (Present Value)	
		Project Number:	
PROJECT:			
NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
	BY EXECUTION OF THIS CHANGE ORDER THE CONTRACTOR AGREES THAT ALL CLAIMS FOR ADDITIONAL CONTRACT TIME AND FEES FOR THE ITEMS IN THIS CHANGE ORDER HAVE BEEN SATISFIED.		
		<b>TOTAL DECREASE:</b>	<b>TOTAL INCREASE:</b>
<b>Contractor:</b> _____ <b>Address:</b> _____ <b>City / State:</b> _____ <b>Contractor Signature:</b> _____ <b>Date</b> _____		THE NET CHANGE OF ADJUSTS THE CURRENT CONTRACT AMOUNT FROM TO	
<b>RECOMMENDATION, CONCURRENCES AND APPROVALS</b>			
	<b>SIGNATURES</b>	<b>DATE</b>	
<b>Consultant / Engineer</b>	_____	_____	
<b>Project Manager:</b>	_____	_____	
<b>Division Manager:</b>	_____	_____	
<b>Department Director/ Deputy Director:</b>	_____	_____	



# ADMINISTRATIVE CONTRACT ADJUSTMENT

Contract Adj. No.:

Page 2 (Continuation)

Project Number:

NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
		DECREASE SUBTOTAL:	INCREASE SUBTOTAL:

SECTION 00700  
GENERAL CONDITIONS

ARTICLE I - DEFINITIONS

Whenever used in the Bid 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 bidding documents or the contract documents.

Agreement - The written Agreement between Owner and Contractor covering the Work to be performed; other contract documents are attached to the Agreement and made a part thereof as provided therein.

Written Amendment - A written amendment of the contract documents, signed by Owner and Contractor on or after the effective date of the Agreement and normally dealing with the non-engineering or non-technical rather than strictly work related aspects of the contract documents.

Application for Payment - The form accepted by 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 Owner's sole and absolute judgment will under all circumstances best serve the public interest. Award shall be made by a majority vote of a quorum of Manatee County Board of County Commissioners in open session; or by the Purchasing Director in accordance with Ordinance 08-43, Manatee County Purchasing Code.

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

Bidder - One who submits a bid directly to the Owner, as distinct from a sub-bidder, who submits a bid to a Bidder.

Bidding Documents - Consists of the Invitation For Bid, which includes but is not limited to: the bid form, drawings, Contract Documents, terms and conditions, and the proposed contract documents (including all Addenda issued prior to receipt of bids); and becomes a part of the Agreement.

Bonds - Performance and payment bonds and other instruments of security.

Change Order - A document recommended by Project Representative which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work, or an adjustment in the contract price or the contract time, issued on or after the effective date of the Agreement.

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

Contract Documents - The Agreement, Addenda (which pertain to the contract documents), Contractor's bid (including documentation accompanying the bid and any post-bid documentation submitted prior to the Notice of Award), the bonds, the specifications and the drawings, together with all amendments, modifications and supplements issued on or after the effective date of the Agreement.

Contract Price - The monies payable by Owner to Contractor under the contract documents as stated in the Agreement.

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 Owner has entered into an Agreement.

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 Owner).

Drawings - The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by Engineer and are referred to in the bidding and contract documents.

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

Excusable Delay - Any delay beyond the control and without the negligence of the Contractor, the Owner, 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 Owner, or epidemics. Labor disputes and above average rainfall shall give rise only to excusable delays.

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.

Field Order - A written order issued by Project Representative which orders minor changes in the Work, but which does not involve a change in the contract price or the contract time.

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.

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 Director in accordance with Ordinance 08-43, Manatee County Purchasing Code.

Notice of Intent to Award - The written notice to the apparent low bidder stating Award has been recommended with final Award to be authorized by the Board of County Commissioners.

Notice to Proceed - Written notice by Owner (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.

Owner - Manatee County, Florida, Board of County Commissioners.

Preconstruction Conference - Prior to starting the Work, a meeting scheduled by Owner 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 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 Owner who is assigned to the project or any part thereof.

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.

Specifications - Those portions of the contract documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

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 Owner.

Substantial Completion - The Work (or a specified part thereof) has progressed to the point when, in the opinion of the Engineer as evidenced by Engineer's definitive certificate of Substantial Completion, it is sufficiently complete in accordance with contract documents so that the work can be utilized for the purposes for which it is intended; or if there be no such certificate issued, when final payment is due.

Successful Bidder - The lowest qualified, responsible and responsive bidder to whom an award is made.

Supplier - A manufacturer, fabricator, supplier, distributor, materialman or vendor.

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 Agreement and signed by Owner 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 may not change the contract price or the 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.

## 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 Owner to govern the Work, to protect the functions of the local government and its citizens and to aid in providing appropriate surveillance. The Owner shall have the right to reschedule work provided such rescheduling is in accord with the remainder of 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 Owner, after necessary rescheduling and obtaining additional information for specific purposes, shall review and approve the schedule. The Contractor shall also forward to the Owner, 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 Owner's review and approval. In addition, more detailed schedules may be required by the Owner 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 Agreement. 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 Owner as insufficient or improper for securing the quality of work required or the required rate of progress, the Owner 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 Owner to demand any increase of such efficiency or any improvement shall not release the Contractor from his 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 Owner may require the Contractor to remove from the Work such employees as the Owner deems incompetent, careless, insubordinate or otherwise objectionable, or whose continued employment on the Work is deemed to be contrary to the Owner's interest.
- 2.4 The Owner 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 Agreement between Owner 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 the County of Manatee.

Should a conflict exist within the contract documents, the precedence in ascending order of authority is as follows: 1) Standard Printed Contract Documents, 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. 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 Owner, 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 Formal Written Amendment
  - 3.3.2 A Change Order
  - 3.3.3 A Work Directive Change
  - 3.3.4 Administrative Contract Adjustment (ACA)
- 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 A Field Order
  - 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 Owner's written consent given after prior notice to Engineer (at least 72 hours in advance).

- 4.2.1 Contractor shall pay for all additional engineering charges to the Owner 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 Owner on account of such overtime work. At Owner'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 Owner 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 Owner or Engineer and any such subcontractor, supplier or other person or organization, nor shall it create any obligation on the part of Owner 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. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work.
- 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 Owner. 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.

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 Owner'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 Owner, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give Owner prompt written notice if Contractor believes that any significant changes in the work or variations from the contract documents have been caused thereby. If Owner 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 Agreement, 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, Owner/Engineer and Contractor shall have access to any available float 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 agreement, are accepted and are less costly than the originally specified materials or equipment, then the net difference in cost shall be credited to the Owner and an appropriate change order executed.

- 4.11.1 If a specific means, method, technique, sequence of 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. Owner 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 Owner for the charges of Engineer and Engineer's Consultants for evaluating each proposed substitute submitted after the effective date of the Agreement 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 Owner, 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 Owner in writing, and the Owner 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 - OWNER'S RESPONSIBILITIES

- 5.1 Owner shall furnish the data required of Owner under the contract documents promptly and shall make payments to the Contractor within a reasonable time (no more than 45 days) after the Work has been accepted by 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 Owner/Engineer. Standard County forms shall be utilized.
- 5.2 The Owner 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 Owner 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 Agreement and without notice to any surety, Owner 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 Owner and Contractor shall execute appropriate change orders (or written amendments) covering changes in the Work which are ordered by Owner, 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 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 Owner'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 20% Contractor's fee for overhead and profit. (Contractor shall submit an itemized cost breakdown together with supporting data.)
- 7.4 Either Owner 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 Agreement; 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 Owner 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 Owner 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 years or as otherwise stated herein) and guarantees to Owner that all work will be in accordance with the contract documents and will not be defective; that Owner, representatives of Owner, 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 Owner).
- 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, Owner 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 Owner 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, Owner may correct and remedy any such deficiency. To the extent necessary to complete corrective and remedial action, Owner 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 Owner has paid Contractor but which are stored elsewhere. All direct, indirect and consequential costs of Owner 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 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 Owner and in accordance with Owner's written instructions, either correct such defective work or if it has been rejected by Owner, remove it from the site and replace it with non-defective work. If Contractor does not promptly comply with the terms of such instruction, Owner may have the defective work corrected/removed and all direct, indirect and consequential costs of such removal and replacement will be paid by Contractor.

## ARTICLE 10 - SUSPENSION/TERMINATION OF WORK

10.1 Owner may, at any time and without cause, suspend the work or any portion thereof for a period of not more than 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.

- 10.2 Owner may terminate the contract if 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 the bankruptcy or insolvency; if a petition is filed against the Contractor under any chapter of the Bankruptcy Code or similar relief under any other federal or state law; if Contractor persistently fails to perform the work in accordance with the contract documents; if Contractor disregards laws or regulations of any public body having jurisdiction or the Engineer; or otherwise violates in any substantial way any provisions of the contract.
- 10.2.1 Owner may, after giving Contractor (and the surety, if there is one) seven (7) days written notice and to the extent permitted by laws and regulations, terminate the services of Contractor; 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 the 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 owner has paid Contractor but which are stored elsewhere, and finish the work as Owner may deem expedient. In such case, 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. If the direct and indirect costs of completing the work exceed the unpaid balance of the contract price, Contractor shall pay the difference to Owner. Such costs incurred by Owner shall be verified by Owner and incorporated in a change order; but in finishing the work, Owner 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 the Agreement.
- 10.3 If, through no act or fault of Contractor, the work is suspended for a period of more than ninety (90) days by Owner or under an order of court or other public authority, or Engineer fails to act on any application or fails to pay Contractor any sum finally determined to be due; then Contractor may, upon seven (7) days written notice to Owner terminate the Agreement and recover from Owner payment for all work executed, any expense sustained plus reasonable termination expenses. In lieu of terminating the Agreement, if Engineer has failed to act on any application of payment or Owner has failed to make any payment as aforesaid, Contractor may upon seven (7) days written notice to Owner stop the work until payment of all amounts then due.

## ARTICLE 11 - CONTRACT CLAIMS

- 11.1 The rendering of a decision by Engineer with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment) will be a condition precedent to any exercise by Owner or Contractor of such right or remedies as either may otherwise have under the contract documents or by laws or regulations in respect of any such claim, dispute or other matter. No action, either at law or at equity, shall be brought in connection with any such claim, dispute or other matter later than thirty (30) days after the date on which Owner/Engineer has rendered such written decision in respect thereof. Failure to bring an action within said thirty (30) day period shall

result in Engineer's decision being final and binding on the Contractor. In no event may any such action be brought after the time at which instituting such proceedings would be otherwise barred by the applicable statute of limitations.

- 11.2 Before bringing any action in court pertaining to any claim, dispute or other matter in question(s) arising out of or relating to the contract documents or the breach thereof, or Engineer's final decision, except for claims which have been waived by the making and acceptance of final payment, the Contractor shall first submit written notice(s) of contract claims to the Purchasing Director for a decision; the Contractor may request a conference with the Purchasing Director. Claims include, without limitation, disputes arising under the contract and those based upon breach of contract, mistake, misrepresentation, or other cause for contract modification or revision. The Purchasing Director is authorized to resolve any claim prior to the filing of a request for a hearing with the Board of County Commissioners or the commencement of an action in a court of competent jurisdiction; but may not settle any such claim for consideration of \$10,000 or more in value without the prior approval of the Board of County Commissioners.

The decision of the Purchasing Director shall be promptly issued in writing to the Contractor. If an adverse decision has been rendered, the notice of decision shall inform the Contractor of his right to request a hearing with the Board of County Commissioners.

- 11.2.1 The Purchasing Director's decision shall be final and conclusive unless, within ten (10) calendar days from the date of receipt of the decision, the Contractor files a written request for hearing with the Board of County Commissioners.
- 11.2.2 If the Purchasing Director does not issue a written decision regarding any contract controversy within fourteen (14) days after receipt of a written request for a final decision, or within such longer period as may be agreed upon between the parties, then the aggrieved party may proceed as if an adverse decision had been issued.

## ARTICLE 12 - RESIDENT PROJECT REPRESENTATIVE - DUTIES, RESPONSIBILITIES

- 12.1 Resident Project Representative is Engineer/Owner's Agent, who will act as directed by and under the supervision of the Engineer, and who will confer with Owner/Engineer regarding his actions. Resident Project Representative's dealing in matters pertaining to the on-site work shall, in general, be only with the Owner/Engineer 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 Owner/Engineer concerning their acceptability.
- 12.2.2 Attend preconstruction conferences. Arrange a schedule of progress meetings and other job conferences as required in consultation with Owner/Engineer and



notify those expected to attend in advance. Attend meetings and maintain and circulate copies of minutes thereof.

- 12.2.3 Serve as Owner/Engineer's liaison with Contractor, working principally through Contractor's superintendent and assist him in understanding the intent of the contract documents. As requested by Owner/Engineer, 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 Owner/Engineer of their availability for examination.
- 12.2.5 Advise Owner/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 Owner/Engineer.
- 12.2.6 Conduct on-site observations of the work in progress to assist Owner/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 Owner/Engineer whenever he 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 Owner/Engineer 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 Owner/Engineer.
- 12.2.10 Transmit to Contractor, Owner/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 Owner/Engineer.
- 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, Owner/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 Owner/Engineer.
  - 12.2.14 Record names, addresses and telephone numbers of all Contractors, subcontractors and major suppliers of materials and equipment.
  - 12.2.15 Furnish Owner/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 Owner/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 Owner/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 Owner/Engineer for his review prior to final acceptance of the work.
  - 12.2.20 Before Owner/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 Owner/Engineer and Contractor and prepare a final list of items to be completed or corrected.
  - 12.2.22 Verify that all items on final list have been completed or corrected and make recommendations to Owner/Engineer concerning acceptance.
- 12.3 Except upon written instructions of Owner/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 Owner/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 Owner 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 In accordance with the requirement of Section 446.011, Florida Statutes, the following requirements to safeguard the welfare of apprentices and trainees shall be a part of this contract, if applicable.
  - 13.1.1 Contractor agrees to hire for the performance of the contract, a number of apprentices or trainees in each occupation which bears to the average number of the journeymen in that occupation to be employed in the performance of the contract, the ratio of at least one apprentice or trainee to every five journeymen.
  - 13.1.2 Contractor agrees, when feasible to assure that 25% of such apprentices or trainees are in their first year of training, except when the number of apprentices or trainees to be hired is fewer than four.
  - 13.1.3 Contractor agrees to submit, at three month intervals, to the Bureau of Apprenticeship of the Division of Labor, records of employment by trade of the number of apprentices or trainees employed; race of all apprentices; the number of apprentices or trainees in their first year of training; and total hours of work of all apprentices, trainees, and journeymen.
  - 13.1.4 Contractor agrees to submit to the Bureau of Apprenticeship of the Division of Labor, at three month intervals, a statement describing steps taken toward making a diligent effort in the hiring of apprentices and trainees and containing a breakdown by craft of hours worked and wages paid for first year apprentices or trainees, other apprentices or trainees and journeymen.

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.

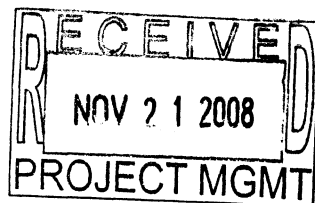
END OF SECTION

**TECHNICAL SPECIFICATIONS**  
**Bid Set**

**Improvements to the Tara #20 Master Lift Station**

*Prepared for:*  
Manatee County  
Project No. 6022087

November 2008



*Prepared by:*

**URS**

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**Manatee County  
Improvements to the Tara #20 Master Lift Station**

**Engineers of Record**

Civil Engineer:

URS Corporation

Craig P. Osmanski, PE  
#48961

Electrical Engineer:

URS Corporation

Glenn H. Davis, PE  
#66443

**MANATEE COUNTY  
IMPROVEMENTS AT THE  
TARA #20 MASTER LIFT STATION**

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**MANATEE COUNTY  
IMPROVEMENTS AT THE  
TARA #20 MASTER LIFT STATION**

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**MANATEE COUNTY  
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**DIVISION 01**  
**GENERAL REQUIREMENTS**

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## 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 Engineer, 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 costs incidental thereto. 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 therefore.

The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship,

materials and equipment, prior approval of the Engineer notwithstanding.

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 whether owned or controlled by the Owner, other governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewage, drainage, water or other public or private property which may be affected by the work shall be deemed included hereunder.

The Contractor shall protect all public utility 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 Engineer. The Contractor shall so arrange his operations as to avoid any damage to these facilities. 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 Engineer. 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 Owner 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 therefore.

Where public utility installations or structures owned or controlled by the Owner 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 Engineer, 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 Engineer, 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.

All Owner and other governmental utility departments and other owners of public utilities which may be affected by the work will be informed in writing by the Engineer within two weeks after the execution of the Contract or Contracts covering the work. Such notice will set out, in general, and direct attention to, the responsibilities of the Owner and other governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the work and will be accompanied by one set of Plans and Specifications covering the work under such Contract or Contracts.

In addition to the general notice given by the Engineer, the Contractor shall give written notice to Owner 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 XXXVIII, 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 Engineer.

## **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 Engineer, 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 Engineer 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 Engineer, 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 Engineer, should such errors or omissions be discovered. All schedules are given for the convenience of the Engineer 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

The names of proposed manufacturers, material men, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity. He shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. 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 Engineer 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 Engineer and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.

The Contractor shall, at his own expense, 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.

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 Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner 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 Owner 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 Engineer 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 Engineer 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 Owner.

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 Owner formally takes over the operation thereof.

#### B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the Owner 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 Owner for compliance. The Contractor shall reimburse the Owner 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 Engineer, 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 Engineer 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 Engineer 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 Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.

Five copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company, shall be forwarded to the Engineer for approval.

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 Owner. 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 by replacement or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees of specified requirements, the Owner, 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 Owner 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 Owner 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 Engineer 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 Engineer, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The Engineer 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 Owner/Engineer. 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 to 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 therefor. 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 Engineer, 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 Owner and to the satisfaction of the Engineer. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the Engineer.

Prior to the beginning of any excavations, the Contractor shall advise the Engineer 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 Owner may order the Contractor, for the convenience of the Owner, to remove trees along the line or trench excavation. If so ordered, the Owner 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 in the manner described in the Workmanship and Materials Paragraph in Section 02485, Seeding & Sodding.

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 Engineer. 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 gasoline motors 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.

Except in the event of an emergency, no work shall be done between the hours of 7:00 P.M. and 7:00 A.M., or on weekends. If the proper and efficient prosecution of the work requires operations during the night or weekends,



the written permission of the Owner shall be obtained before starting such items of the work.

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 Engineer 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 Engineer, 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 Engineer 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**

**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 various improvements at Tara #20 Master Lift Station (MLS). The following work will be performed at the lift station: installation of new pumps, level sensor, flow meter, and pressure transducer; replacement of existing PVC piping with stainless steel piping and replacement of the discharge valves in the valve vault; installation of a new gantry hoist system; installation of a new emergency generator including a fuel tank and sound attenuated enclosure; reworking of the lighting in the pump station area; installation of a new electrical building with new electrical service, main circuit breaker, transformer, power distribution panelboards, generator automatic transfer switch, variable frequency drives, lighting, air conditioning, and an Owner provided/ Contractor installed Control Cabinet to control the pumps and drives and provide monitoring signals to the SCADA system; and bypass pumping, as necessary, to perform the work.
- 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 Owner.
- 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 Owner's use of the premises during the construction period; coordinate the construction schedule and operations with the Owner'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. Owner's Use.
  - 3. Public Use.
- B. Coordinate use of work site under direction of Engineer or Owner'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 Owner or separate contractor.
- E. Obtain and pay for the use of additional storage of work areas needed for Contractor operations.

**1.05 OWNER 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 Owner, 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 Owner 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 Owner has the option of not accepting the entire work as a whole until it is completed, tested and approved by the Engineer and Owner.

**1.06 PARTIAL OWNER OCCUPANCY**

The Contractor shall schedule his operations for completion of portions of the Work, as designated, for the Owner'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 Engineer 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 Engineer 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 adjacent property owner.

##### 1.03 WORK LOCATIONS

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

##### 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 Engineer 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 Engineer 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 Engineer 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 Engineer, permanent relocation of a utility owned by the Owner 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 Owner will notify the utility to perform the work as expeditiously as possible.

The Contractor shall fully cooperate with the Owner 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 at the direction of the Engineer. Test pits shall be backfilled 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 Engineer.
- 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 Engineer 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 Engineer. 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 Engineer.
- 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 Engineer and Owner.
- C. Detours around construction areas will be subject to the approval of the Owner and the Engineer. Where detours are permitted, the contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the Contractor shall expedite construction operations and periods when traffic is being detoured, will be strictly controlled by the Owner.

**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 hydrant 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 Engineer and Owner 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 Engineer.

**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 Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required.

Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the 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 Owner.

**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**

## 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 Owner 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 Engineer. 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 terminus of the existing systems all as shown on the Drawings or where directed by the Owner/Engineer. The cost for this work and for the actual connection to the existing systems shall be included in the price bid for the project and shall not result in any additional cost to the Owner. 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 Engineer.

##### **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 water, sewer, gas, telephone, electrical, or other 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. Cost for relocation of all existing lines shall be included in the price bid for the project. Should damage occur to an existing line, the Contractor shall bear the cost of all repairs.

- 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 of any such excavation by the Contractor.
- 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 Engineer of the location of the pipeline or utility and shall reroute or relocate the pipeline or utility as directed. Cost for relocation of existing pipelines or utilities shall be included in the price bid for the project.
- 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 Engineer and/or the owner of the utility.
- 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 Engineer 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 Engineer and Owner a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in case of a hurricane warning.
- B. In the event of inclement weather, or whenever Engineer 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 Engineer, 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 Engineer or Owner and if so shall be protected for a reasonable time until picked up by the Owner. Any equipment or material not worthy of salvaging, as directed by the Engineer, 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 Engineer, 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 Owner'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 Engineer.

**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 Engineer or County for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price.
- 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 Owner 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 Owner.
- 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 Owner 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 Owner acceptance of the equipment.

**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 Engineer. Do not proceed with work until Engineer 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. All survey work required in execution of Project.
  - 2. All costs of construction layout shall be included in the unit and lump sum prices contained in the respective divisions of the Contract Bid Form.
  - 3. Civil, structural or other professional engineering services specified or required to execute Contractor=s construction methods.

##### 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 approved by the Owner. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the Engineer.

##### 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.
  - 1. Make no changes or relocations without prior written notice to Engineer.

2. Report to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
3. Require surveyor to replace project control points which may be lost or destroyed.
4. 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**

Maintain a complete, accurate log of all control and survey work as it progresses.

The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data, confirm horizontal and vertical measurements and properly prepare record drawings on mylar and 3-1/2" diskettes. The Record Drawings, together with two copies, shall be certified by the licensed professional and shall be submitted to the Owner/Engineer.

**1.06 SUBMITTALS**

- A. Submit name and address of Professional Surveyor and Mapper to Engineer for Owner's approval.
- B. Submit certificate signed by the Professional Surveyor and Mapper certifying that elevations and locations of improvements are in conformance, or nonconformance, with Contract Documents.

**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.

- 1.02 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  
 1791 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

MCUOD Manatee County Utility Operations Department  
4410 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 24<sup>th</sup> 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**



## 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 Owner/Engineer 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.

**1.07 UNIT PRICE ITEM**

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.

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 Owner until as-built (record) drawings have been submitted and approved by the Engineer.

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 hydromulching.
16. As-built Record Drawings.

**BID ITEM NO. 1 - MOBILIZATION**

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.

Payment for mobilization shall not exceed 10 percent (10%) of the total Contract cost unless the Contractor can prove to the Owner that his actual mobilization cost exceeds 10 percent (10%).

**BID ITEM NO. 2 -  
CIVIL/MECHANICAL/STRUCTURAL/ELECTRICAL/INSTRUMENTATION  
WORK**

Payment for all work included under this Bid Item shall be made at the Contract lump sum price listed in the Bid Form and shall represent full compensation for all labor, materials and equipment required for improvements to Tara #20 Master Lift Station including, but not limited to: erosion and sedimentation control; demolition; excavation, including rock; dewatering; sheeting; fill; compaction; grading; surface restoration; asphalt work; relocation of odor control system; concrete work; surface preparation and painting; wet well liner repair; electrical work; coordinating with electric utility; instrumentation work; bypass pumping; emptying and cleaning wet well; and furnishing and installing pumps and accessories, piping, pipe restraining, fittings, valves, saddles and hot taps, manhole, precast concrete building, generator automatic transfer switch, fuel tank, generator, sound attenuated generator enclosure, fuel piping/hoses, generator accessories, silencer, electrical components, variable frequency drives (VFDs), transformer, panelboards, circuit breakers, lighting, bollards, doghouse manhole, flowmeter, level measurement, pressure transducer, sluice gates, aluminum access hatches, monorail hoist system, and miscellaneous metals. The work shall also include installation of an Owner provide Control Cabinet, including all required connections for a fully operable system.

Payment for all work included under this lump sum Bid Item shall represent full compensation for furnishing all labor, materials, equipment and incidentals required to complete the improvements to the Tara #20 MLS as specified in Divisions 1 through 16 and as shown on the Contract Drawings ready for approval by the Engineer and acceptance by the Owner.

Payment for this lump sum bid item shall also include all other appurtenances and related work which are not specified or shown but are required to complete the work of the improvements to the Tara #20 MLS.

Measurement for periodic payments of this lump sum bid item will be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

**BID ITEM NO. 3 - MISCELLANEOUS WORK AND CLEANUP**

Payment for all work under this Bid Item shall be made at the Contract lump sum price bid listed in the Bid Form and shall represent full compensation for all labor, materials and equipment required to perform all the work as shown on the Contract Drawings and specified herein and any other miscellaneous work not specifically included for payment under other Bid Items obviously necessary to complete the Contract. Partial payments will be based on the breakdown of the Bid Item in accordance with the Schedule of Values submitted by the Contractor and approved by the Engineer. Payment shall also include full compensation for project photographs and video, survey and redline drawings, permits, project signs, rubbish and spoil removal, and all other items required to complete the project in accordance with the Contract Documents.

**BID ITEM #4 - DISCRETIONARY WORK**

Payment for all work under this Bid Item and listed in the Bid Form shall be made only at the Owner's discretion in order to satisfactorily complete the project in accordance with the Plans and Specifications.

**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 Owner and Contractor.

**1.02 FORMAT AND DATA REQUIRED**

- A. Submit payment requests in the form provided by the Owner 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 Owner or the Engineer 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**

**SECTION 01153**

**CHANGE ORDER PROCEDURES**

**PART 1 GENERAL**

**1.01 DEFINITION**

- A. Change Order: See General Conditions.
- B. Field Directive Change: See General Conditions.

**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 Engineer 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.
- C. The Board of County Commissioners executes all Change Orders.

**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 change for the Contractor to proceed with additional work within the original intent of the Project.
- B. Field Directive change 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 change 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 Engineer/Owner 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, plus additional information.
1. Name of the Owner'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. Form: see Section 00550 for sample form.
- C. Change Order will describe changes in the Work, both additions and deletions, with attachments as necessary to define details of the change.
- D. 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 Owner, 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 Owner for approval. The Owner 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. Owner's definition of the scope of the required changes.
  - 2. Contractor's Proposal for a change, as approved by the Owner.
  - 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 Owner 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. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.
- C. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
- D. Owner 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.
  - 1. 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 Owner or Engineer 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. Owner's Engineer.
  - 2. Owner'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. Owner's REQUIREMENTS.
- 7. Temporary utilities.
- 8. Housekeeping procedures.
- 9. Liquidated damages.
- 10. Equal Opportunity Requirements.
- 11. Laboratory testing.
- 12. Job meetings.

**1.03      PROGRESS MEETINGS**

- A. Schedule regular meetings. The progress meetings may be held every 30 days or less with the first meeting 30 days after the pre-construction meeting.
- B. Hold special meetings as required.

**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 Owner 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 Owner. 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 Owner. Such permission, however, may be revoked at any time by the Owner 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.

**1.03        PROGRESS OF THE WORK**

The work shall be executed with such progress as may be required to prevent any delay to the general completion of the work. The work shall be executed at such times and in or on such parts of the project and with such forces, materials and equipment to assure completion of the work in the time established by the Contract and in the manner set forth in the Contract.

**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 Engineer to review Contractor's planning, scheduling, management and execution of the work; to assist Engineer 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 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.
- D. The schedules shall be prepared and submitted using the latest version of Microsoft Project, or other Owner approved software.

**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 Engineer to review all submittals as set forth in the Contract Documents; items of work required of Owner 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 Owner.
- 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 Engineer, 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 Engineer. 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 Engineer 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 three copies of 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 Owner, 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 monthly progress schedules with each month's application for payment.
- G. Contractor shall submit three monthly status reports which will be retained by the Owner and Engineer.

## **2.06 MONTHLY STATUS REPORTS**

- A. Contractor shall submit three copies of 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 Engineer and Contractor at a monthly schedule meeting and Contractor will address Engineer'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 Engineer 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. Engineer shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of Engineer's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by Owner, 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 by Engineer and concurrence by Owner. 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 Engineer, for one of the following reasons:
  - 1. Owner or Engineer directs a change that affects the date(s) specified in the Agreement or alters the length of a critical path.
  - 2. Contractor elects a change that affects the date(s) specified in the Agreement or alters the length of a critical path.
- C. If, prior to agreement on an equitable adjustment to the Contract time, Engineer requires revisions to the schedule in order to evaluate planned progress, Contractor shall provide an interim revised submittal for review with change effect(s) incorporated as directed. Interim revisions to the documents which are recommended to the Owner for concurrence will be incorporated in the next Monthly Status Report.

## **PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

## SECTION 01340

### SHOP DRAWINGS, PROJECT DATA AND SAMPLES

#### PART 1 GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. The Contractor shall submit to the Engineer 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. Within thirty (30) calendar days after the effective date of the Agreement, the Contractor shall submit to the Engineer, a complete list of preliminary data on items for which Shop Drawings are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specified items and the date on which each Shop Drawing shall be submitted. Review of this list by the Engineer shall in no way relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings.
- C. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:
1. Submittal description and number assigned.
  2. Date to Engineer.
  3. Date returned to Contractor (from Engineer).
  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 Engineer 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 Engineer 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 Engineer 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 Engineer, with No Exceptions Taken or Approved As Noted.
- E. The Contractor shall submit to the Engineer 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 Engineer receives them.
- F. The Contractor shall submit five (5) copies of descriptive or product data submittals to complement shop drawings for the Engineer plus the number of copies which the Contractor requires. The Engineer shall retain five (5) sets. All blueprint shop drawings shall be submitted with one (1) set of 3 mil thick polyester film reproducibles. The Engineer will review the blueprints and return to the Contractor the set of marked-up sepias with appropriate review comments.
- 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 Engineer of the necessary Shop Drawings.

**1.04 ENGINEER'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS**

- A. The Engineer'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 Engineer, 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 Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting any exception.
- D. When reviewed by the Engineer, 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 Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.
- 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 Engineer.
- G. The Engineer 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 Engineer's actual payroll cost.

- H. When the Shop and Working Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.
- I. 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 Engineer 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 Engineer 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 Engineer will utilize the color "red" in marking shop drawing submittals.
- I. Before final payment is made, the Contractor shall furnish to Engineer project as-built drawings.

#### **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 Engineer where required by the Contract Documents or requested by the Engineer and shall be submitted at least thirty (30) days (unless otherwise specified by the Engineer) 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 Engineer, 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 Owner and Engineer shall not have responsibility therefor.

**1.07 SAMPLES**

- A. The Contractor shall furnish, for the review of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer 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 Engineer.
- 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 Engineer. 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 Engineer 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**

**SECTION 01370**

**SCHEDULE OF VALUES**

**PART 1 GENERAL**

**1.01 REQUIREMENTS INCLUDED**

- A. The Contractor shall submit to the Engineer 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 Engineer, 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 Engineer 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**

## SECTION 01381

### PHOTOGRAPHIC DOCUMENTATION

#### PART 1 GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. The Contractor shall employ a competent photographer to take construction record photographs or perform video taping, including furnishing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video tapes of all construction areas.
- B. Preconstruction record information shall consist of both photographs and video tapes.
- 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 two prints 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. The Contractor shall require that photographer maintain negatives for a period of two years from date of substantial completion of the project.
  - 3. Photographer shall agree to furnish additional prints to Owner and Engineer 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 photographer's 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 Engineer at each period of photography for instructions concerning views required.

**1.04 VIDEO TAPE RECORDINGS**

- A. Video taping shall be done within the limits of construction. Video taping shall include full taping of the area including the condition of adjacent buildings, adjacent equipment, structures, sidewalks, driveways, etc. All video taping 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 orientation in the audio portion of the tapes.
- D. Two complete sets of video tapes shall be delivered to the Engineer for the permanent and exclusive use of the Engineer prior to the start of any construction on the project.
- E. All video tapes shall contain the name of the project, the date and time of the video taping, the name and address of the photographer and any other identifying information required.
- F. Construction shall not start until preconstruction video tapes are completed, submitted and accepted by the Engineer. In addition, no progress payments shall be made until the preconstruction video tapes are accepted by the Engineer.

**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. Owner 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. Owner 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 Engineer 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 Owner 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 Owner 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 Engineer.

H. If the test results indicate the material or equipment complies with the Contract Documents, the Owner 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 maintenance of traffic plan from the FDOT Maintenance of Traffic Standards, Series 600 of the FDOT Roadway & Traffic Design Standards, Latest Edition.
- B. The Contractor shall provide at least 72 hours notification to the affected highway department of the necessity to close any portion of a roadway carrying vehicles or pedestrians so that final approval of such closings can be obtained at least 48 hours in advance. 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. It shall also be the Contractor's responsibility to notify the School Board, police, fire and emergency departments whenever roads are impassable.
- 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 Engineer will consult with the Owner 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.

**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.

**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 Owner.
  - 3. Names and titles of authorities as directed by Owner.
  - 4. Prime Contractor.
- B. Graphic design, style of lettering and colors: As approved by the Engineer and subject to approval of the Owner.
- C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the Engineer and the Owner

**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.

**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**

**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 Engineer.
  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 Engineer.
1. 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.
  - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding.
  - 2. Do not proceed with work without clear instructions.
- C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.

**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 STORAGE AND PROTECTION**

- A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible
  - 1. Store products subject to damage by the elements in weather tight enclosures.
  - 2. Maintain temperature and humidity within the ranges required by manufacture's instructions.
- B. Exterior Storage
  - 1. Store fabricated products above the ground, on blocking or skids to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
- D. Protection After Installation
  1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

**1.05 SUBSTITUTIONS AND PRODUCT OPTIONS**

A. Products List

1. Within 30 days after Contract date, submit to Engineer a complete list of major products proposed to be used.

B. 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.
3. Requests for substitutions of products and "or equal" by the Contractor shall be submitted 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.
  - 1. Store in accord with manufacturer's instructions, with seals and labels intact and legible.
- B. Store products subject to damage by elements in substantial weather tight enclosures.
  - 1. Maintain temperatures within ranges required by manufacturer's instructions.
  - 2. Provide humidity control for sensitive products, as required by manufacturer's instructions.
  - 3. Store unpacked products on shelves, in bins or in neat piles, accessible for inspection.
- C. 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.
- D. 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.
    - a. 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 Engineer. 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 Engineer.
  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 Engineer 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. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer. These instructions shall be carefully followed.
  5. 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.

6. Lubricants shall be changed upon completion of installation and as frequently as required, thereafter during the period between installation and acceptance.
7. 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 Engineer and Owner 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 Engineer determines that the work is not substantially complete:
  - 1. The Engineer 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 Engineer.
  - 3. The Engineer shall reinspect the work.
- E. When the Engineer finds that the work is substantially complete:
  - 1. He shall prepare and deliver to the Owner 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 Owner as provided in Conditions of the Contract. When the Engineer considers the work substantially complete, he will execute and deliver to the Owner and the Contractor 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 Owner's representative and are operational.
  5. The work is completed and ready for final inspection.
- B. The Engineer shall make an inspection to verify the status of completion after receipt of such certification.
- C. If the Engineer determines that the work is incomplete or defective:
  1. The Engineer 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 Engineer that the work is complete.
  3. The Engineer shall reinspect the work.

- D. Upon finding the work to be acceptable under the Contract Documents, the Engineer 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 Owner for the Engineer=s fees.

**1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER**

- 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-8).

**1.05 FINAL ADJUSTMENT OF ACCOUNTS**

- A. Submit a final statement of accounting to the Engineer.
- 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**

## **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 Owner 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 Owner one record copy of:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Engineer'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 Engineer.

**1.03 MARKING DEVICES**

- A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

**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 + 1/2 inch.
  15. The Contractor shall submit to the Owner/Engineer, properly prepared redline drawings marked up by the Contractor and survey data certified by a design professional (Engineer and/or Surveyor registered in the State of Florida), employed by the Contractor.
- 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, deliver Record Documents (redline drawings and survey drawing) to the Engineer.
- B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data. The Contractor shall supply the record documents to the Engineer for preparation of the record drawings. Record drawings shall be certified by the design professionals, the Engineer (licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and dated mylar drawings together with a CD of the electronic files, AutoCad Release 12 or later for review and the use of the County in the following format:

The CD shall contain media in AutoCad Version 12 or later, 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.

- C. All record drawing requirements must be submitted to the Engineer prior to starting the bacteria testing of water lines.
1. Accompany submittal with transmittal letter in duplicate, containing:
    - a. Date.
    - b. Project title and number.
    - c. Contractor's name and address.
    - d. Title and number of each Record Document.
    - e. 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. All valves, fire hydrants, manholes, water, reclaim 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 an easement, shall be located by elevation and by station and offset based on intersection PI'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.
- B. Elevations shall be provided as listed above and 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.
- C. Slopes for pipe and ditches shall be recalculated, based on actual field measured distances, elevations, pipe size and type shown. Cross section of drainage ditches and swales shall be verified.
- D. 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.
- E. Record drawings shall show bearings and distances for all right-of-way and easement lines, and property corners.
- F. 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 the centerline of right-of-way to the facility.
- G. 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.

- H. Underdrain cleanouts for retention systems outside right-of-way shall be located by station and offset from an appropriate baseline.
- I. Sanitary sewer mainline wyes shall be located from the downstream manhole. These dimensions shall be provided by on-site inspections or televising of the sewer following installation.
- J. Elevations shall be provided on the top of operating nuts for water and force main valves at major intersections connecting to County and/or State roads at proposed or existing arterial highways and at drain crossings.
- K. Allowable tolerance shall be + 6 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 of + 1/2 inch.

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

## SECTION 01721

### REDLINE DRAWINGS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. Contractor shall provide Redline Drawings to the Engineer for preparation of the Record Drawings.
  - 1. The provisions of this Section apply to the maintaining, marking, recording, and submitting of Redline Drawings.
  - 2. The Contractor shall maintain a set of Redline Drawings at the job site. These shall be kept legible and current and shall be available for inspection during normal working hours by the Owner/Engineer. Do not use redline drawings for construction purposes, protect from deterioration and loss in a secure, fire-resistive location. Show all changes or Work added on these Record Drawings in a contrasting color.

##### 1.02 RELATED WORK

- A. Section 01700, Contract Closeout.
- B. Section 01720, Project Record Instruments

##### 1.03 SUBMITTALS

- A. Redline Drawings: At completion of all Work under this Contract, deliver Redline Drawings to the Engineer with transmittal, containing as a minimum, the following:
  - 1. Date.
  - 2. Project title and numbers.
  - 3. Contractor's name and address. Include final list of all subcontractors.
  - 4. Title and number of each record document.
  - 5. Certification that each document as submitted is complete and accurate.
  - 6. Contractor's signature or that of the Contractor's authorized representative.

##### 1.04 REDLINE DRAWINGS

- A. The redline drawings shall be current and included with each month's pay estimate application, and subject to the Engineer's review for acceptability, as a prerequisite to monthly payment.



- B. In particular, show changes in the Work in relation to way in which shown and specified by original Contract Documents; and show additional information of value to Owner's records, but not indicated by original Contract Documents.
- C. In showing changes in the Work, use the same legends as used on the original drawings. Indicate exact locations by dimensions and exact elevations by job datum. Give dimensions from a permanent point.
- D. Mark whichever drawings are most capable of showing conditions fully and accurately.
- E. Use a red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
- F. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Do not conceal any work until required information is recorded.
- G. Mark-up important additional information which was either shown schematically or omitted from original drawings.
- H. Note related Change Order numbers where applicable.
- I. Do not revise the prints by attaching the actual sketches issued by the Engineer. Where the work was installed exactly as shown on the Contract Drawings, the prints shall not be disturbed other than being marked "PROJECT RECORD".
- J. Each sheet shall be clearly marked "PROJECT RECORD".
- K. Review the completed Redline Drawings and ascertain that all data furnished on the prints is accurate and truly represents the work as actually installed.
- L. The redline drawing prints, including those changed and unchanged, shall be submitted to the Engineer for compliance review.
- M. Any deviations from the method of executing Redline Drawings as described above will be considered just cause for rejection by the Engineer and the Contractor will be required to conform and resubmit.
- N. Maintain a clean, undamaged, updated set of blue or black line white-prints of Contract Drawings, including sheets issued as part of County authorized changes. The set shall be marked to scale by a competent draftsman to indicated the actual installation and/or location where the installation and/or location varies substantially from the Work as originally shown due to Addenda, Alternates, Change Orders, Field Orders, etc.

**END OF SECTION**

**SECTION 01730**

**OPERATING AND MAINTENANCE DATA**

**PART 1 GENERAL**

**1.01 REQUIREMENTS INCLUDED**

- A. Compile product data and related information appropriate for Owner'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 Owner'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 Owner'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 Owner's personnel.
- D. Prepare and include additional data when the need for such data becomes apparent during instruction on Owner'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 OWNER'S PERSONNEL**

- A. Prior to final inspection or acceptance, fully instruct Owner'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**

## 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 Engineer for review and transmittal to Owner.

##### **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 Owner'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.
    - a. 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 Owner 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 02**  
**SITE WORK**

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**SECTION 02001**

**SPECIAL PROVISIONS TO DIVISION 2**

The following Special Provisions to Division 2 supplement and/or supercede the Manatee County Specifications included in Division 2.

**SECTION 02220**

**EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES**

**PART 3 EXECUTION**

**Add the Following:**

**3.07 PREPARATION OF STRUCTURAL SUBGRADE**

- A. In the Electrical Building and Emergency Generator System areas, the cleared and grubbed surfaces shall be compacted to at least 98 percent of the maximum dry density as indicated by the Modified Proctor compaction test (ASTM D-1557) prior to placing any fill or constructing any concrete pads.

**END OF SECTION**

**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, shall also be installed as directed by the Engineer.

- 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 Engineer.
- 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 Owner, except that items not salvageable, as determined by the Engineer and the Owner, 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.
- 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.
- 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 17-251, "Asbestos".
  - 2. National Emission Standards Hazardous Air Pollution (NESHAP), 40 CFR, Part 61, Subpart M, latest revision.
  - 3. Occupational Safety and Health Act, 29 CFR

4. The Environmental Protection Agency (EPA) Asbestos Abatement Worker Protection Rule.
5. Florida Statute 455.300.

### **3.04 ASBESTOS CEMENT PIPE REMOVAL**

- A. All asbestos cement pipe sections shown on the Drawings to be removed, and all related valves, fittings and appurtenances shall be removed in their entirety and disposed of by the Contractor in accordance with this Section. 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 Contractor shall make necessary provisions for the Engineer's representative to monitor all removal operations.
- C. The cutting of existing asbestos-cement (A/C, aka "Transite") pipe shall be by hand saw only. No machine cutting shall be allowed. Removal of all portions of pipe shall be double bagged prior to shipment. Longer sections of pipe removed may be shipped without double bagging. 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.

### **3.05 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 Engineer. 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 Engineer to determine if adequate grout material has filled the entire pipe section(s). The Contractor shall make necessary provisions for the Engineer'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 Engineer.

**END OF SECTION**

**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 Engineer 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 Engineer. 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 Owner 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 Owner within a five mile radius of the construction site. Should Owner not choose to receive any or all excess topsoil materials, the Contractor shall dispose of said material at no additional cost to Owner.

**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 Engineer 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 Engineer 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 Engineer.

**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 Engineer.
- 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 Engineer.
- 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, sanding 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 Engineer.
- 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 Engineer.

**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 Engineer.
- 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 Engineer who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the Engineer.
- C. The elevations of the footing bottom and the base slab as shown on the Drawings, shall be considered as approximate and the Engineer 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 Engineer, 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 Engineer 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 Engineer 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.
- 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 Engineer. The Contractor shall securely tamp the backfill with pneumatic rammer around all wall foundations. The method of compaction shall be satisfactory to the Engineer.
- D. Compaction of structural backfill by ponding and jetting shall be permitted when, as determined by the Engineer: 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 Engineer, ponding and jetting may be permitted with compaction layers not to exceed four feet. The work shall be performed without damage to the structure or embankment and in such a manner that water will not be impounded.
- 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 shall 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 Engineer.
- 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 Engineer.
  - 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 Engineer. During the progress of the work, the Engineer 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



Owner/Engineer. 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 Engineer 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 Engineer 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 Engineer 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 Engineer.
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 Engineer of the source of the material and shall furnish the Engineer, 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 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. Base Course

1. Asphalt, crushed concrete, soil cement or approved equal, shall be used as base course for bituminous paved roads and parking areas.

#### D. 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 Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

E. 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 FILL PLACEMENT**

A. General

1. Material placed in fill areas under and around pipelines and structures shall be deposited within the lines and to the grades shown on the Drawings or as directed by the Engineer, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the Engineer. If sufficient common fill material is not available from excavation on site, the Contractor shall provide borrows as may be required.
2. Limerock base course material, structural fill and screened limerock, may be provided as borrow.
3. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.
4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots, debris and stones greater in size than specified under Materials, shall be removed from the fill areas. The Contractor shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.
5. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.
6. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas and is required to perform the work in such manner as to preserve the undisturbed state of the natural inorganic soil.

**3.02 COMPACTION**

- A. Structural fill, limerock base course and screened limerock in open areas, shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted by a minimum of six coverages (3 passes each way) with the equipment described below, to at least 98 percent of the maximum density, as determined by AASHTO T-180. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum six coverages.
- B. Common fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exceptions: layer thickness prior to compaction may be

increased to 12-inches in open areas; and common fill except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one foot above the water level at the time of filling.

- C. Compaction equipment in open areas shall consist of a medium-heavy vibrator roller (minimum static weight of 10 tons) operated at resonant frequency and at a speed of 2 fps or less or other compaction equipment approved by the Engineer.
- D. Areas adjacent to pipelines, structures and other confined areas inaccessible to the vibrator roller shall be compacted with a manually operated sled-type vibratory compactor. The Contractor shall also conform to additional backfill requirements at pipelines and structures as specified in the Contract Documents. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired equipment, and the Engineer may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Unless such tests indicate that modifications may be made, the fill compacted by mechanical compactors shall be placed in 6-inch layers and thoroughly tamped over the entire surface.

Compaction equipment is subject to approval by the Engineer.

- E. It is the intention that the fill materials with respect to moisture be used in the condition they are excavated insofar as this is practicable. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.
- F. If the Engineer shall determine that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.
- G. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place the water in the fill in the manner specified.

### **3.03 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 Engineer may direct, sufficiently to prevent subsequent settling.

### 3.04

#### GRADING

- A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- B. If at the time of excavation it is not possible to place any material in its proper section of the permanent pipeline structure, it shall be stockpiled in approved areas for later use.
- C. Minute adjustments in lines or grades may be made if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.
- D. Stones or rock fragments larger than 2-1/2" in their greatest dimensions shall not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.
- E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.
- F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All fill slopes shall be uniformly dressed to the slope, cross section and alignment shown on the Drawings or as directed by the Engineer.
- G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are relocated, or where

lines are to be abandoned and removed, all required valves are closed and drains plugged at manholes.

**END OF SECTION**

3/05/97

**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 Engineer, 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 Engineer 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 Engineer 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 Engineer and the excavation shall be refilled with crushed stone or washed shell.

**END OF SECTION**

**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 Owner.

**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 Engineer.



- 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 grades 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 Engineer. 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 reseeded 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 Owner/Engineer.
- 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 Owner/Engineer.
- 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. South Florida Building Code and Standard 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 Owner.
- B. Seed and sod.

**2.02 SEDIMENTATION CONTROL**

- A. Bales - clean, seedfree cereal hay type.
- B. Netting - fabricated of material acceptable to the Owner.
- 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 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 Engineer/Owner.

**1.02 RELATED WORK NOT INCLUDED**

- A. 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. Requirements

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 Owner 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.

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 Engineer.

**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 quantitative 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 Engineer 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 Owner. 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 Engineer.

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 Engineer 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 Owner shall be repaired by the Contractor as directed by the Engineer.

**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**

Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the Engineer.

Maintain landscape work for a period of 90 days immediately following complete installation of work or until Owner 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 Owner.

**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**



**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 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 Engineer.

### **3.02 PAVEMENT REPAIR AND REPLACEMENT**

- A. The Contractor shall repair, to meet or exceed original surface material, all existing pavement 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 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**

**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, restrained joint ductile iron pipe and cast iron or ductile iron 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. Newly installed pipe shall be kept clean and free of all foreign matter.

**1.02 SUBMITTALS**

- A. The Contractor shall submit to the Engineer, 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 AWWA C150 and AWWA C151. Thickness of pipe shall be Pressure Class 350. All ductile iron pipe used in above ground applications shall be Special Thickness Class 53. The pipe exterior coating shall be a standard 1 mil asphaltic coating per AWWA C151. All ductile iron pipe shall be clearly marked on the outside of the barrel to readily identify it. All pipe materials used in potable water systems shall comply with NSF Standard 61.
- B. Unrestrained joint pipe shall be supplied in lengths not to exceed 21 ft. and shall be either the rubber-ring compression-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 an approved equal.
- C. All fittings shall be pressure rated for 350 psi for sizes 4-24 inches and 250 psi for

sizes 30 inches and larger and shall meet the requirements of AWWA C110 or AWWA C153.

- D. Rubber gaskets shall conform to AWWA C111 for mechanical and push-on type joints and shall be EPDM rubber for potable water and reclaimed water pipelines. Standard gaskets shall be such as Fastite as manufactured by American Cast Iron Pipe Company, or an approved equal.

- E. Water Mains and Reclaimed Water Mains:

All ductile iron pipe used in water and reclaimed water systems shall have a standard thickness cement lining on the inside in accordance with AWWA C104. All ductile iron or gray iron fittings used in water and reclaimed water systems shall have standard thickness cement linings on the inside per AWWA C104 and asphaltic exterior coatings or they shall have factory-applied fusion bonded epoxy coatings both inside and outside in accordance with AWWA C550.

- F. Sewer Mains:

- 1. All ductile iron pipe and all ductile iron and cast iron fittings used in wastewater sewer systems shall have a factory applied fusion bonded minimum dry film thickness 40-mil Protecto 401 or Amine Cured Novalac\_ceramic epoxy lining or minimum 60-mil Polybond Plus polyethylene lining with a fusion bonded epoxy primer layer on the inside in accordance with the manufacturer's specifications. The interior lining application is to be based on the manufacturer's recommendation for long-term exposure to raw sewage. To ensure a holiday-free lining, documentation must be provided, prior to shipment, showing each section of lined pipe has passed the holiday testing at production per ASTM G62 with a minimum 10,000 volt charge. The lining shall have a minimum ten year warranty covering failure of the lining and bond failure between liner and pipe.

- 2. The discharge header pipe with welded on outlets shall be as manufactured by American Cast Iron Pipe Company. Joints shall be mechanical joint and restrained. Nominal pipe thickness shall be Special Class 53. The outlets shall be rated at 250 psi working pressure. Welded on outlets for ductile iron pipe shall be fabricated with qualified procedures and welders in accordance with ANSI/AWS D11.2, Guide for Welding Iron Castings. Interior lining shall be in accordance with paragraph 2.01, F, 1.

- G. Ductile iron or cast iron pipe and fittings used in sewer systems shall have either an asphaltic coating per AWWA C151 or a factory applied fusion bonded epoxy exterior coating.

- H. Thrust restraint devices shall be provided at all horizontal and vertical bends and fittings, in casings under roads and railroads and at other locations as indicated on the construction drawings. Thrust restraint devices shall be either concrete thrust blocks or restraining glands as manufactured by Star Pipe Products, Stargrip 3000 and 3100, Allgrip 3600, or as manufactured by EBAA Iron Sales, Megaflange, 2000 PV, or other approved equal restraining gland products. Restrained joints, where used, shall be installed at bend and fitting locations and at pipe joint locations both upstream and downstream from the bends or fittings at distances as required by these Standards. 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 DETECTION**

- A. Pipe shall have a 3-inch wide detectable metallic tape of the proper color placed directly above the pipe 12-inches below finished grade or a 6-inch detectable tape between 12-inches and 24-inches below finished grade.
- B. Pipe shall have a No. 10 gauge solid, insulated wire of proper color installed along the pipe alignment as detailed in these standards.

## **2.03 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 water mains, purple (Pantone 522 C) for reclaimed water mains and green for sewer mains.

**END OF SECTION**

**SECTION 02617**

**INSTALLATION AND TESTING OF PRESSURE PIPE**

**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 Owner/Engineer 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.

**1.02 PROCEDURE FOR TESTING WATER LINES, FORCE MAINS AND RECLAIMED WATER LINES**

- A. The Engineer must call in to schedule all testing. 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. Engineer 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. All water and sewer lines will be installed per approved construction plans by the County. If any revisions or changes are made after initial testing, lines will be retested 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 Engineer 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 owner and obtain the best as-built information available. Allow sufficient time for the owner to field locate the existing pipe lines.
- 2) Submit drawings of proposed location to the Owner 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 Owner 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.

**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 Engineer including, but not limited to, dimensions and technical specifications for all piping.
- B. The Contractor shall submit to the Engineer, 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, where shown or as specified on the Drawings, 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 Engineer. 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 Engineer. 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 Engineer.
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 Engineer so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be a single 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**

- A. 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 Engineer to prevent movement during tests.

**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.
- 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 Engineer 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 Engineer for approval in accordance with the Specifications.

**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 boxes.
- 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 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. The valves shall have a non-rising stem of stainless steel or of cast, forged, or rolled bronze as shown in AWWA C509. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar.
- F. The sealing mechanism shall consist of a cast iron gate fully encapsulated with an EPDM Elastomer coating. The Elastomer type shall be permanently indicated on the disc or body of the valve. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
- G. The valve body, bonnet, and bonnet cover shall meet or exceed all the requirements of AWWA C509 latest edition. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. Wrench nut shall be provided for operating the valve.
- H. Valves shall be suitable for an operating pressure of 200 psi and shall be tested in accordance with AWWA C509.
- I. 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. 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, Kennedy, or approved equal. The valve discs shall be constructed of cast iron conforming to ASTM A-48, Class 40, ASTM A-126, Class B or ductile iron conforming to ASTM A536, Grade 65-45-12 for Class 150 or less. 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 2 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 dismantling 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. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in Section 5.5.
- 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 hobbled 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 Limatorque 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

1. 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 Engineer. 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.
2. 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.
3. 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.
4. 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.
5. 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. Victaulic 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, American, Kennedy, M&H, or approved equal.
- 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.
- 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 Engineer shall be installed.

## **2.16 HYDRANTS**

Hydrants shall be AVK Series 27 DRX Barrel (nostalgic style with stainless steel bolts) Kennedy Type K-81, American Darling B-84-B or Mueller Super Centurian A423, 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 Engineer.
- 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 Engineer.
- 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 Engineer 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.

### **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 Engineer. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

**END OF SECTION**

## SECTION 02770

### BYPASS PUMPING

#### PART 1 GENERAL

##### 1.01 GENERAL

- A. The Contractor is referred to conditions and requirements given in various Divisions of the Specifications and Section 01005, General Requirements, insofar as such documents affect the work of this Section.
- B. The Contractor's attention is referred to the conditions and requirements for temporary utilities as specified in Section 01510 - Temporary and Permanent Utilities.

##### 1.02 SCOPE

- A. The Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc. to implement a temporary pumping system for the purpose of diverting the lift station influent flow around the Tara #20 Master Lift Station, so that the station can be rehabilitated.
- B. The design, installation, and operation of the temporary pumping systems shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the Engineer that he specializes in the design and operation of temporary bypass pumping systems.
- C. The Contractor shall provide temporary pumping systems. The system shall be capable of pumping raw wastewater from the manhole at the influent side of the pump station to the new bypass connection at the effluent side, as shown on the Drawings, completely bypassing the existing station. The temporary pumping system shall be capable of pumping the variable wastewater flows received by the lift station. The Bypass Pumping System shall be capable of pumping up to 150% of the peak flow conditions with one pump and provide a backup pump for 100% redundancy.
- D. It is required under this section that the Contractor provide all necessary means to safely convey the normal flows past the work areas. It will not be permitted to stop or impede the sanitary sewer flows under any circumstances.
- E. The Contractor's bid price shall include the following for each bypass pumping system: one pump and a backup with sound attenuation housing (maximum noise level of 70dBA @ 7 meters) as well as all necessary controls, a high water alarm signal (light) to indicate pump operational problems and to activate the backup pump,

a responsible operator on hand at all times when pumps are operating, and 24 hour on-call maintenance personnel. The contractor shall be capable of having maintenance personnel onsite within one hour of receiving notice that there are problems associated with a bypass pumping system.

### **1.03 SPECIAL PRECAUTION**

- A. The Contractor is notified that the bypass pumping at the lift stations is critical and must be maintained at all times. If any spills of raw wastewater occur due to the failure of the Contractor to maintain the temporary pumping when needed, the Contractor shall be responsible for any fines levied on Manatee County by the FDEP or any other applicable agency.

### **1.04 SHOP DRAWINGS**

- A. Contractor shall submit shop drawings detailing sewage bypass system. Information that must be contained in the shop drawings shall include, but not be limited to:
1. Pump curves and installation details
  2. Control system logic and details
  3. Piping system
  4. Emergency phone number
  5. Noise attenuation system
  6. Bypass Pumping System Vendor information and qualifications

## **PART 2 - PRODUCTS**

### **2.01 PUMPS**

- A. The pumps and drives shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation, or vibration. The pump shall not overload the driver at any point on the pump operating curve. Rotative components shall be statically and dynamically balanced. The pump shall be suitable for use with raw unscreened sewage and trash. The pump shall be a self-contained unit, designed for temporary use.
- B. All pumps used shall be fully automatic self priming units that do not require the use of foot-valves or vacuum pumps in the priming system. The pumps shall be diesel powered. All pumps used must be constructed to allow dry running for long periods

of time to accommodate the cyclical nature of flows.

- C. Pumps shall be engine driven on skid bases or highway trailer with centralized lifting bracket and integral fuel tank. The pump shall be direct coupled to an electric start diesel engine.
- D. Pump shall have a ductile iron casing, suction cover, separation tank, and non-return valve, a high nickel steel open impeller, front and rear wear plate, shaft sleeve and shaft.
- E. Pump seals shall be constructed of silicon carbide, of the mechanical type, and shall be located in an oil bath. This will allow lubrication by the oil, not the wastewater and will allow pump operation at periods of low flow.
- F. The current peak flow conditions for the Tara #20 Pump Station is:
  - 1. 1,730 gpm at 100 feet TDH.
- G. The Bypass Pumping Systems shall be capable of pumping up to 150% of the peak flow conditions with only one of the two bypass pumps operating:
  - 1. 2,600 gpm at 150 feet TDH.

## **2.02 PUMP CONTROLS**

- A. The bypass pumps shall have manual start/stop. One pump shall run at all times during bypass pumping operations. A high water alarm signal (light) for the manhole will indicate pump operational problems and activate the backup pump.

## **2.03 PIPING**

- A. In order to prevent the accidental spillage of flows, all discharge system must be constructed of semi-rigid pipe with positive, leak-proof connections. All pipe must be 100 psi rated working pressure and full vacuum. Adequate vents will be provided suitably arranged to prevent spillage of raw sewage.
- B. Pipe shall be high density polyethylene pipe with fused joints or ductile iron pipe with flanged joints or victaulic couplings for a leak-proof piping system.
- C. "Irrigation" type pipe or aluminum construction pipe will not be acceptable.

## **2.04 TEMPORARY PLUGS**

- A. Plugs shall be inflatable plugs constructed of cross-biased cording reinforced natural rubber. Plugs shall be equipped with steel pull rings, cast aluminum ends, and a



rupture disk to prevent overinflation. Inflatable plugs shall model Test-Ball as manufactured by Cherne Industries of Minneapolis, MN, or equal.

- B. All plugs shall be firmly attached to a stationary object at ground level by a steel cable in order to prevent loss of plug in the pipeline.

### **PART 3 - EXECUTION**

#### **3.01 TEMPORARY BYPASS PUMPING INSTALLATION**

- A. Equipment specified in this section shall be installed in strict accordance with the manufacturer's instructions and recommendations. Installation shall include furnishing oil, fuel, grease, lubricants, tools and spare parts that may be required to maintain the operation of the pump throughout the construction period, as recommended by the manufacturer. The Contractor shall be solely responsible for maintaining the temporary pumps and appurtenances. At the end of the construction period, the contractor shall remove the pumps and appurtenances.
- B. The pumps are to be installed for temporary use only and shall be removed by the Contractor prior to completion of the contract. The contractor shall be responsible for proper operation of the complete pumping system, which includes pump, driver, controls, and appropriate pipe connections, during the construction period.
- C. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.
- D. The Contractor shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.
- E. The temporary pumping system shall be placed in service a minimum of 24 hours before any work may begin.
- F. Once written permission is issued, the Contractor shall remove all components of the temporary pumping system. The Contractor shall perform all restoration work to the satisfaction of the Owner.

**END OF SECTION**

**SECTION 02999**

**MISCELLANEOUS WORK AND CLEANUP**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes items and operations which are not specified in detail as separate items, but may be sufficiently described as to the kind and extent of work involved. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to complete all work under this Section.
- B. The work of this Section may include, but is not limited to the following:
  - 1. Restoration of roads, sidewalks, driveways, curbing and gutters, fences, guardrails, lawns, shrubbery and any other existing items damaged or destroyed.
  - 2. Crossing utilities.
  - 3. Relocation of existing water, reclaim water, or sewer lines less than four inches diameter, water and sanitary sewer services, low pressure gas lines, telephone lines, electric lines, cable TV lines as shown on the Contract Drawings.
  - 4. Restoring easements (servitudes) and rights-of-way.
  - 5. Clean up.
  - 6. Incidental work (project photographs, testing, shop drawings, traffic control, record drawings, etc.).
  - 7. Excavation and Embankment - As defined in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction (1991 Edition or latest revision).

**1.02 SUBMITTAL OF LUMP SUM BREAKDOWN**

Contractor shall submit to the Owner/Engineer, a breakdown of the lump sum bid for Miscellaneous Work and Cleanup Item in the Proposal within 10 days after date of Notice to Proceed.

**1.03 WORK SPECIFIED UNDER OTHER SECTIONS**

All work shall be completed in a workmanlike manner by competent workmen in full compliance with all applicable sections of the Contract Documents.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

Materials required for this Section shall equal or exceed materials that are to be restored. The Contractor may remove and replace or reuse existing materials with the exception of paving.

**PART 3 EXECUTION**

**3.01 RESTORING OF ROADS, CURBING, FENCES AND GUARDRAILS**

- A. The Contractor shall protect existing curbing. If necessary, curbing shall be removed from joint to joint and replaced after backfilling. Curbing damaged during construction because of the Contractor's negligence or convenience, shall be replaced with curbing of equal quality and dimension at no cost to the Owner.
- B. At the locations necessary for the Contractor to remove, store and replace existing fences and guardrails during construction, the sections removed shall be only at the direction of the Engineer. If any section of fence is damaged due to the Contractor's negligence, it shall be replaced at no cost to the Owner with fencing equal to or better than that damaged and the work shall be satisfactory to the Engineer.
- C. Guardrails in the vicinity of the work shall be protected from damage by the Contractor. Damaged guardrails shall be replaced in a condition equal to those existing.
- D. Road crossings shall be restored in accordance with the Contract Documents and current FDOT Standards. Compensation for road restoration shall be included under the Road Restoration Bid Item if specified or under Miscellaneous Cleanup if it is not specified.

**3.02 CROSSING UTILITIES**

This item shall include any extra work required in crossing culverts, water courses, drains, water mains and other utilities, including all sheeting and bracing, extra excavation and backfill, or any other work required or implied for the proposed crossing, whether or not shown on the Drawings.

**3.03 RELOCATIONS OF EXISTING GAS LINES, TELEPHONE LINES, ELECTRIC LINES AND CABLE TV LINES**

The Contractor shall notify the proper utility involved when relocation of these utility lines is required. The Contractor shall coordinate all relocation work by the

utility so that construction shall not be hindered.

**3.04**

**RESTORING THE EASEMENTS AND RIGHTS-OF-WAY**

The Contractor shall be responsible for all damage to private property due to his operations. He shall protect from injury all walls, fences, cultivated shrubbery, pavement, underground facilities, including water, sewer and reclaimed water lines and services, or other utilities which may be encountered along the easement. If removal and replacement is required, it shall be done in a workmanlike manner, at his expense, so that the replacement are equivalent to that which existed prior to construction.

**END OF SECTION**

**DIVISION 03**  
**CONCRETE WORK**

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**SECTION 03310**

**CONCRETE WORK**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

A. Scope:

1. The extent of concrete work is shown on the Drawings.

**1.2 RELATED WORK**

- A. Section 01340 - Project Data, Samples and Shop Drawings
- B. Section 02615 – Ductile Iron Pipe and Fittings
- C. Section 11100 – Pumping Systems

**1.3 SUBMITTALS**

- A. Product Data: Submit product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and others as requested by the Engineer.
- B. Shop Drawings, Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Conform to ACI 315, showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required at formed openings through concrete structures.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for concrete materials and mix design test as specified.
- D. Material Certificates: It is preferable to provide copies of materials certificates in lieu of materials laboratory test reports when permitted by the Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

**1.4 REFERENCE STANDARDS**

- A. Codes and Standards: Conform to provisions of the following, except as otherwise indicated or specified:

1. American Concrete Institute (ACI):
    - a. ACI 301 Specifications for Structural Concrete for Buildings.
    - b. ACI 304 Guide for Measuring, Mixing, Transporting, and Placing Concrete.
    - c. ACI 305 Hot Weather Concreting.
    - d. ACI 306 Standard Specification for Cold Weather Concreting.
    - e. ACI 311.4R Guide for Concrete Inspection
    - f. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
    - g. ACI 318 Building Code Requirements for Reinforced Concrete.
    - h. ACI 347 Recommended Practice for Concrete Formwork.
    - i. ACI 504R-90 Guide to Sealing Joints in Concrete Structures.
  2. American Society for Testing and Materials (ASTM):
    - a. Referenced Standards.
  3. Concrete Reinforcing Steel Institute (CRSI):
    - a. Manual of Standard Practice.
  4. U.S. Army Corps of Engineers (CE):
    - a. CE CRD-C 513 Specification for Rubber Waterstop.
    - b. CE CRD-C 572 Specification for Polyvinyl-Chloride Waterstops.
  5. United States Department of Commerce, National Institute of Standards and Technology; Product Standards (PS):
    - a. PS-1 U.S. Product Standard for Construction and Industrial Plywood.
- B. Concrete Testing Service:
1. Materials and installed work may require testing and retesting, as directed by the Engineer, at any time during progress of work. Contractor shall retain an independent testing laboratory to perform testing.

## **PART 2 - PRODUCTS**

### **2.1 FORM MATERIALS**

- A. The design and removal of all formwork is solely the responsibility of the Contractor.
- B. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork, for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Cardboard tube forms are not acceptable. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
  - 1. Use medium density overlay (MDO) plywood conforming to PS-1 M.D. Overlay, Group 1, Exterior Grade.
- C. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- D. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- E. Form Ties: Use factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
  - 1. Unless otherwise indicated and except as noted, provide ties so portion remaining within concrete after removal is 1-1/2 inches inside concrete and will not leave holes larger than 1 inch diameter in concrete surface.

### **2.2 REINFORCING MATERIALS**

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports conforming to CRSI



Specifications, unless otherwise acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
3. Where underside of lintels are exposed, bars shall be suspended such that chairs which cause spalling are not used.

### 2.3 CONCRETE MATERIALS

#### A. General:

1. Portland Cement: ASTM C 150, Type I or II.
2. Aggregates: ASTM C 33, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalis in the cement.
3. Water: Potable, or free from foreign material in amounts harmful to concrete and embedded steel.
4. Admixtures: Provide admixtures for concrete that contain not more than 0.1-percent of chloride ions.
5. Slag, Fly Ash, and Other Pozzolanic Materials: ASTM C 618, Type C or Type F.
6. The materials used in concrete shall contain no hardened lumps, crusts, or frozen matter and shall not be contaminated with dissimilar material.

B. Types of Cement: Unless a specific type of cement is designated elsewhere, cement used in concrete shall be Type I, Type IP, Type IS, Type IP(MS), Type II, or Type III.

C. Fly Ash, Slag, and Other Pozzolanic Materials: Fly ash, slag, or other pozzolanic materials may be used as a cement replacement or as an admixture in concrete when Type I, Type II, or Type III cement is used.

D. Mixing Different Coarse Aggregates: Substitution of aggregate of the same type and grade from a different source in an approved concrete mix may be permitted at the discretion of the Engineer.

- E. Admixtures:
1. Air Entraining Admixture: ASTM C 260.
  2. Water Reducing Admixture: ASTM C 494, Type A, and contain not more than 0.1 percent chloride ions.
  3. High Range Water Reducing Admixture (Superplasticizer): ASTM D 495, Type D, and contain not more than 0.1 percent chloride ions.
  4. Water Reducing Non-Chloride Accelerator Admixture: ASTM C 494, Type D, and contain not more than 0.1 percent chloride ions.
  5. Water Reducing Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.1 percent chloride ions.
  6. Chemical admixtures or additives containing calcium chloride shall not be permitted. Provide admixture manufacturer's written certification that chloride ion content is zero percent.

## 2.4 RELATED MATERIALS

- A. Waterstops: Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as indicated. Size to suit joints. Provide either rubber or PVC waterstops as follows:
1. Rubber Waterstops: CE CRD-C 513.
    - a. Products: Provide rubber waterstops by one of the following:
      - (1) The Burke Co.
      - (2) Progress Unlimited.
      - (3) Williams Products, Inc.
  2. Polyvinyl Chloride Waterstops: CE CRD-C 572.
    - a. Products: Provide polyvinyl chloride waterstops by one of the following:
      - (1) Afco Products.
      - (2) The Burke Co.
      - (3) W.R. Meadows, Inc.
      - (4) Progress Unlimited.
      - (5) Vinylex Corp.

- B. Nonshrink, Nonmetallic Grout: Factory packaged nonstaining grout conforming to ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
1. Products: Provide one of the following products:
    - a. "Euco-NS"; Euclid Chemical Co.
    - b. "Vibropruf #11"; Lambert Corp.
    - c. "Masterflow 928"; Master Builders Technologies, Inc.
    - d. "SonogROUT 14"; Sonneborn Building Products-Chemrex Inc.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd., conforming to AASHTO M 182, Class 2.
- D. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
1. Waterproof paper.
  2. Polyethylene film.
  3. Polyethylene-coated burlap.
- E. Liquid Membrane Forming Curing Compound: Liquid type membrane-forming curing compound conforming to ASTM C 309, Type 1-D. Moisture loss not more than 0.55 gr./sq. cm. when applied at 200 sq. ft./gal. Compound to be clear and colorless at time of application and not change to a yellow or amber color over time and exposure.
1. Products: Provide one of the following products:
    - a. "Clear Seal"; Tamms Div., LaPorte Construction Chemicals.
    - b. "Masterkure 200W"; Master Builders Technologies, Inc.
    - c. "Klearseal"; Setcon Industries.
    - d. "Kure-N-Seal"; Sonneborn Building Products-Chemrex, Inc.
- F. Bonding Compound: ASTM C 1059. Where concrete placement will be protected (interior) or delayed, use rewettable Type 1 bonding agent. Where concrete will be placed immediately after application of bonding agent, use non-rewettable acrylic Type II.
1. Products, Rewettable Type: Provide one of the following products:
    - a. "Euco Weld"; Euclid Chemical Co.
    - b. "Hibond"; Lambert Corp.
    - c. "Everweld"; L&M Construction Chemicals, Inc.

2. Products, Non-Rewettable Type: Provide one of the following products:
  - a. "Acrylic Bondcrete"; The Burke Co.
  - b. "SBR Latex"; Euclid Chemical Co.
  - c. "Acrylbond"; Lambert Corp.
  - d. "Sonocrete"; Sonneborn Building Products-Chemrex, Inc.
  
- G. Epoxy Adhesive: ASTM C 881, Type IV, two component 100 percent solids material suitable for use on dry or damp surfaces. Provide material grade and class to suit project requirements.
  1. Products: Provide one of the following products:
    - a. "Burke Epoxy M.V."; The Burke Co.
    - b. "Euco Epoxy System #452 or #620"; Euclid Chemical Co.
    - c. "Sikadur 32 Hi-Mod"; Sika Chemical Corp.
  
- H. Joint Filler Material: Preformed strips of asphalt saturated fiberboard, conforming to ASTM D 1751.
  
- I. Hardener/Sealer/Dustproofer:
  1. Products: Provide one of the following products:
    - a. "Burk-O-Lith"; The Burke Co.
    - b. "Surfhard"; Euclid Chemical Co.
    - c. "Saniseal"; Master Builders Technologies, Inc.
    - d. "Lapidolith"; Sonneborn Building Products-Chemrex, Inc.
  
- J. Sealer for Form-Lined Concrete and Adjacent Vertical Concrete: Colorless, proprietary solution for sealing concrete surfaces.
  1. Product: "Clear Pruf"; The Burke Co.

## 2.5 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency, acceptable to Engineer, at Contractor's expense for preparing and reporting proposed mix designs.
  1. Do not use the same testing agency for field quality control testing.
  2. Limit use of fly ash to not exceed 20 percent of cement content by weight.

- B. Submit written reports to the Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by the Engineer.
- C. Design mixes to provide normal weight concrete, as indicated on Drawings. Maximum w/c ratio shall be as specified in ACI 301.
- D. Slump Limits: proportion and design mixes to result in concrete slump at point of placement as follows:
  - 1. Ramps, slabs, and sloping surfaces: Not more than 3-inches.
  - 2. Reinforced foundation systems: Not less than 1-inch and not more than 3-inches.
  - 3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8-inches after adding admixture to site-verified 2-to3-inch slump concrete.
  - 4. Other concrete: Not more than 6-inches.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; as accepted by the Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Engineer before using in work.

## 2.6 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with the requirements of ASTM C94, and as herein specified.
- B. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
- C. When the air temperature is between 85 degrees F and 90 degrees F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F, reduce the mixing and delivery time to 60 minutes.

## 2.7 ADMIXTURES

- A. Use water reducing admixture of high range water reducing admixture (super plasticizer) in concrete as required for placement and workability.

- B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50-degrees F.
- C. Use high-range water-reducing admixture in pumped concrete, heavy-use slabs, architectural concrete, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
  - 1. Concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 percent to 4 percent air.
- E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

## **PART 3 - EXECUTION**

### **3.1 FORMS**

- A. The Contractor shall be solely responsible to design, erect, support, shore, reshore, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances conforming to ACI 347.
- B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming

keyways, reglets, recesses, rustications, and the like, to prevent swelling and for easy removal.

- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar matrix. Locate temporary openings on forms at inconspicuous locations.
- F. Chamfer exposed corners and edges 3/4 inch unless otherwise indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

### 3.2 PLACING REINFORCEMENT

- A. Comply with CRSI's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement as called for on Drawings. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

### 3.3 JOINTS

- A. Construction Joints: Locate and install construction joints, as indicated, or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to the Engineer.
- B. Provide keyways in all construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs. Construct keyways 1-1/2 inches deep unless otherwise detailed.
- C. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints.
- D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops pursuant to manufacturer's published instructions.
  - 1. Waterstops shall be securely held in position using split form dimensional lumber to hold waterstop rigidly within the casting to a true linear profile. Concrete shall be properly consolidated around the waterstop so that no voids or honeycombing occurs adjacent to the waterstop, thus maintaining sealing integrity. The Contractor shall remove all concrete spillage from the waterstop upon completion of the days concrete pour.
- C. Isolation Joints in Slabs-On-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated. Construct isolation joints using joint filler material herein specified. Maintain top of strips of filler material at 1/4 inch + (maximum) below top of finish slab.
- D. Control Joints in Slabs-on-Ground: Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/8 to 1/4 inch wide x 1/4 of the slab depth, unless otherwise shown.
- E. Form control joints by inserting a pre-molded plastic, hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. Tool slab edges round on each side of insert. After the concrete has cured, remove inserts and clean groove of loose debris.

### 3.4 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers



of items to be attached thereto.

- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

### **3.5 PREPARATION OF FORM SURFACES**

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with a form-coating compound before concrete is placed.
- C. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions pursuant to form-coating compound manufacturer's published instructions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply pursuant to manufacturer's published instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### **3.6 CONCRETE PLACEMENT**

- A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other trades sufficiently in advance, to permit installation of their work; cooperate with other trades in setting such work. All aforementioned work must be completed and the Engineer and/or Owner notified at least 24 hours prior to concrete placement to allow time for adequate inspection. Moisten wood forms immediately before placing concrete where form coating is not used.
  - 1. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
  - 2. Construction Sequence: Before placing any concrete, complete blasting, heavy earthwork and other construction operations, which might cause damage to concrete structures.

- B. General: Conform to ACI 304 and as specified.
1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
  2. Concrete shall NOT drop freely from a height greater than 5-feet.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
1. Cold joints will not be allowed except as approved by the Engineer.
  2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete pursuant to ACI recommended practices.
  3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
  3. Maintain reinforcing in proper position during concrete placement

operations.

- E. Cold Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When air temperature has fallen to or is expected to fall below 40 degrees F., uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use salt or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs. Do not use calcium chloride.
  
- F. Hot Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 or as specified in Section 2.06.
  - 1. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
  - 2. Fog spray forms, reinforcing steel, and subgrade just before placing concrete.
  - 3. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineer.

### **3.7 FINISH OF FORMED SURFACES**

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
  
- B. Smooth Formed Finish: Provide a smooth form finish on formed concrete surfaces exposed to view or to be covered with a coating materials applied directly to concrete, or a covering material applied directly to concrete, such as

waterproofing, dampproofing, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.8 MONOLITHIC SLAB FINISHES

- A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane so that depressions between high spots do not exceed 1/4 inch under a 10 foot straight edge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- B. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, paint, tile, or other thin-film finish coating system.
1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.
  2. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance and with a level surface plane so that depressions between high spots do not exceed 1/8 inch under a 10 foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.
- C. Trowel and Fine Broom Finish:
1. Where ceramic tile is to be installed with a thin-set mortar, apply trowel finish as specified, then immediately follow with fine brooming to create a slightly scarified surface.

- D. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete flatwork, steps and ramps, and elsewhere as indicated.
  - 1. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with the Engineer before application.

### 3.9 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
  - 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days pursuant to ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by curing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
  - 1. Provide moisture curing by following methods:
    - a. Keep concrete surface continuously wet by covering with water.
    - b. Continuous water-fog spray.
    - c. Covering concrete, surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.
  - 2. Provide moisture-cover curing as follows:
    - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.
  - 1. Final cure concrete surfaces to receive liquid floor sealer/dustproofer/hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.
  - 2. Provide curing compound to exposed interior slabs and to exterior slabs, walks, and curbs; as follows:
    - a. Apply specified curing compound to concrete slabs as soon as final finishing operations are complete (within 2-hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3-hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - b. Do not use membrane curing compounds or a sealer on surfaces which are to be covered with coating material applied directly to concrete such as liquid floor hardener, waterproofing, damproofing, membrane roofing, flooring (such as ceramic tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

### **3.10 REMOVAL OF FORMS**

- A. Formwork not supporting weight of concrete, such as sides of beams, wall, columns, and similar parts of the work, may be removed, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

### 3.11 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the Engineer.

### 3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-in: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
  - 1. Grout base plates and foundations, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- C. Curbs: Provide monolithic finish to curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

### 3.13 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Engineer.
  - 1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.
  - 2. Patch holes left by tie rods and bolts with a mixture of sand and cement which, after curing, closely matches the appearance of the surrounding

wall surface.

- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify the surface plane to tolerance specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
1. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inch wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
  2. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
  3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.
- D. Repair defective areas, except random cracks and single holes not exceeding 1 inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type of class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.



- E. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
- F. Perform structural repairs with prior approval by the Engineer for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of the Engineer.

### 3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Employ at Contractor's expense a testing laboratory to perform tests and to submit test reports.
- B. Sampling and testing for quality control during placement of concrete may include the following, as directed by the Engineer.
  - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C94.
    - a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
    - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
    - c. Concrete Temperature: Test hourly when air temperature is 40 deg. F. and below, and when 80 deg. F. and above; and each time a set of compression test specimens is made.
    - d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required.

- e. Compressive Strength Tests: ASTM C 39; one set for each day's pour plus additional set for each 100 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
  2. When frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
  3. When total quantity of a given class of concrete is less than 50 cu. yds., Engineer may waive strength test if adequate evidence of satisfactory strength is provided.
  4. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
  5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results will be reported in writing to the Engineer, ready-mix producer, and Contractor within 24 hours that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day test and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

**END OF SECTION**

**DIVISION 05**  
**METALS**

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**SECTION 05100**

**STRUCTURAL STEEL**

**PART 1 GENERAL**

**1.01 REFERENCES**

- A. American Institute of Steel Construction (AISC):
  - 1. Specifications and Code of Standard Practice.
  - 2. Specifications for Structural Joints.
  - 3. Standard Connections.
  
- B. American Society for Testing and Materials (ASTM):
  - 1. A36, Standard Specification for Carbon Structural Steel.
  - 2. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - 3. A325, Standard Specification for High-Strength Bolts for Structural Steel Joints.
  - 4. A490, Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
  - 5. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 6. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
  - 7. F436, Standard Specification for Hardened Steel Washers.
  - 8. F959, Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
  - 9. Other specification sections as required.
  
- C. American Welding Society (AWS): ANSI/AWS D1.1, Structural Welding Code Steel.

**1.02 SUBMITTALS**

- A. Shop Drawings:
  - 1. Meet requirements of AISC.
  - 2. Provide details showing:
    - a. Members and their connections.
    - b. Anchor bolt layouts.
  - 3. Name and address of manufacturer(s).
  - 4. Product specifications.

5. Manufacturer's testing procedures and standards.
6. Preparation and installation or application instructions, as appropriate.

B. Quality Control Submittals:

1. Welder Certifications (less than one year old):
  - a. Submit for shop and field welders.
  - b. Issued by recognized testing laboratory.
2. Weld Inspection Test Reports: Submit to Owner prior to completion of Work.
3. High-Strength Connection Bolts (Galvanized and Nongalvanized):
  - a. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
  - b. Manufacturer's inspection test report results for production lot(s) furnished, to include:
    - 1) Tensile strength.
    - 2) Yield strength.
    - 3) Reduction of area.
    - 4) Elongation and hardness.
  - c. Certified Mill Test Reports for Bolts and Nuts:
    - 1) Name and address of manufacturer.
    - 2) Bolts correctly marked.
    - 3) Marked bolts and nuts used in required mill tests and manufacturer's inspection tests.
4. Mill Certificates.
5. Direct Tension Indicators: Furnish manufacturer's test report meeting requirements of ASTM F959.

### 1.03 QUALITY ASSURANCE

A. Qualifications:

1. Welders: Meet requirements of ANSI/AWS D1.1 for procedures and qualifications of welders.

B. Regulatory Requirements: Comply with current provisions, except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including "Commentary of the AISC Specification."
3. AISC "Specifications for Structural Joints Using ASTM A325 or ASTM A490 Bolts" approved by Research Council on Structural Connections of the Engineering Foundation; endorsed by American Institute of Steel Construction and Industrial Fasteners Institute.

4. AWS Structural Welding Code ANSI/AWS D1.1 and "Standard Qualification Procedure."
5. Manual of Steel Construction, American Institute of Steel Construction, Inc.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.
- B. Storage:
  1. Protect structural steel members and packaged materials from corrosion and deterioration.
  2. Store in dry area and not in direct contact with ground.
- C. Handle materials to avoid distortion or damage to members or supporting structures.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Rolled Shapes: ASTM A992, Grade 50 unless otherwise shown.
- B. Structural Steel Pipe: ASTM A501, or ASTM A53, Type E or S, Grade B.
- C. Structural Tubing: ASTM A500, Grade B (fy equals 46 ksi); provide full length members without splices unless otherwise noted or approved.
- D. Miscellaneous steel: ASTM A36.

#### **2.02 FASTENERS**

- A. Anchor Bolts: As specified in Section 05500, Miscellaneous Metals.
- B. High-Strength Connection Bolts: ASTM A325 or ASTM A490, with the length required when hardened washers and load indicator washers are used.
- C. Hardened Washers: ASTM F436, type to match bolt type and finish.
- D. Direct Tension Indicators (Load Indicator Washers): Meet requirements of ASTM F959.

1. Manufacturer: Cooper-Turner, Bristol, PA.

## **2.03 FABRICATION**

### **A. General:**

1. Fabricate as shown on Drawings and in accordance with AISC Specifications, Contractor's erection requirements, and approved Shop Drawings.
2. Mark and match mark materials for field assembly.
3. Complete assembly, including bolting and welding of units, before start of finishing operations.
4. Fabricate to agree with field measurements.

### **B. Connections:**

1. Shop Connections: Weld or bolt, as shown.
2. Develop full strength of members joined and meet requirements of AISC Standard Connections, unless otherwise shown.

### **C. Welded Construction: Comply with ANSI/AWS D1.1 for procedures, appearance, and quality of welds, and methods used in correcting welding Work.**

### **D. Interface With Other Work:**

1. Holes: As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.
  - a. No torch cut holes are permitted.
2. Weld threaded nuts to framing, and other specialty items as shown to receive other Work.

## **2.04 SOURCE QUALITY CONTROL**

### **A. Shop Inspection:**

1. Owner may inspect fabrication and shop assembly of members and high-strength bolted and welded connections. Fabricator to perform tests and prepare test reports.
2. Furnish facilities for inspection of materials and workmanship. Provide Owner with unlimited access to the Work.

## **PART 3 EXECUTION**

### **3.01 ERECTION**

- A. Install Contractor designed temporary construction bracing to provide necessary support until all components are in place and construction is complete.
- B. Sequence erection.
- C. Meet requirements of AISC Specifications and Code of Standard Practice.
- D. Hardened Washers:
  - 1. Provide at locations required by Washer Requirements section of AISC Specification for Structural Joints using ASTM A325 or ASTM A490 Bolts.
  - 2. Install under turned element (bolt head or nut) and between turned element and indicator washer protrusions.
- E. High-Strength Connection Bolts:
  - 1. Use ASTM A325 bolts unless otherwise shown.
  - 2. Use special indicator washer location requirements of ASTM F959 at all slip-critical bolt connections.
  - 3. Tighten in accordance with AISC Specification for Structural Joints using ASTM A235 or A490 bolts, using Direct Tension Indicators for slip-critical connections.
  - 4. Assembly Tightening: Progress systematically from most rigid part of joint toward free edges until indicator washers on all bolts have been closed to average gap less than that shown in Table 2 of ASTM F959.
  - 5. Do not substitute load indicating washers for hardened flat washers required for oversized holes.

### **3.02 ANCHOR BOLTS**

- A. Coordinate installation of Anchor Bolts and other connectors required for securing structural steel to in-place work.
- B. Provide templates and other devices for presetting bolts and other anchors to accurate locations.

### **3.03 SETTING BASES AND BEARING PLATES**

- A. Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to surfaces.
- B. Clean bottom surface of base and bearing plates.



- C. Set loose and attached baseplates and bearing plates for structural members on wedges, leveling nuts, or other adjustable devices.
- D. Tighten anchor bolts after supported members have been positioned and plumbed.
- E. Grout under baseplates prior to placing loads on structure.

### **3.04 FIELD ASSEMBLY**

- A. Set structural frames accurately to lines and elevations shown.
- B. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.
- C. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.
- D. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.
- E. Level and plumb individual members of structure within AISC tolerances.
- F. Establish required leveling and plumbing measurements on mean operating temperature of structure.
- G. Bolt field connections except where welded or other connections are shown.

### **3.05 MISFITS AT BOLTED CONNECTIONS**

- A. Where misfits in erection bolting are encountered, immediately notify Owner for selection of industry standard remedy method:
  - 1. Ream holes that must be enlarged to admit bolts and use oversized bolts.
  - 2. Drill additional holes in the connection, conforming with AISC Standards for bolt spacing and end and edge distances, and add additional bolts.
  - 3. Reject member containing misfit, incorrect sized, or misaligned holes and fabricate a new member to ensure proper fit.
- B. Do not enlarge incorrect sized or misaligned holes in members by burning or by use of drift pins.

### **3.06 MISFITS AT ANCHOR BOLTS**

- A. Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.

- B. Do not flame cut to enlarge holes.

### **3.07 GAS CUTTING**

- A. Do not use gas cutting torches in field for correcting fabrication errors in structural framing.
  - 1. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by Owner.
- B. Finish gas-cut sections equivalent to sheared appearance.

### **3.08 FIELD QUALITY CONTROL**

- A. High-Strength Bolted Connections: All high-strength bolted connections will be visually inspected in accordance with the AISC Specification for Structural Joints using ASTM A325 or ASTM A490 bolts as follows:
  - 1. Marking identification and conformance to ASTM standards.
  - 2. Bearing-type connections for snug-tight condition.
  - 3. Slip-critical connections for proper location and tightening of load indicator washers.
  - 4. Proper location and use of hardened washers.
- B. Weld Testing Requirements: All welded connections for structural steel will be subject to inspection and nondestructive testing by the Owner's representative in accordance with the ANSI/AWS D1.1 Structural Welding Code-Steel as follows:
  - 1. Qualification records for welding procedures and welding operators.
  - 2. Visual inspection of all welds.
  - 3. Perform a magnetic particle test on 25 percent of all fillet welds. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested at the Contractor's expense.
- C. Provide unlimited access to the Work.
- D. Repair of Defective Connections:
  - 1. All defective and improperly tightened high-strength bolted connections shall be corrected.
  - 2. All defective welds shall be repaired and retested in accordance with ANSI/AWS D1.1.

**END OF SECTION**

## **SECTION 05500**

### **MISCELLANEOUS METALS**

#### **PART 1 GENERAL**

##### **1.1 SCOPE OF WORK**

Furnish all labor, materials, equipment, and incidentals required to install all miscellaneous metal as shown on the Drawings and specified herein.

##### **1.2 RELATED WORK**

- A. Section 03310 – Concrete Work
- B. Section 05100 – Structural Steel
- C. Section 14620 – Bridge Crane and Monorail Hoist Systems
- D. Section 15890 – Ductwork

##### **1.3 SUBMITTALS**

- A. Manufacturer's literature describing standard items.
- B. Shop drawings showing materials, sizes, finishes, locations, attached hardware and fittings, and details for manufactured items and fabricated metalwork, including field erection details showing cuts, copes, connections, holes, thread fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards. Indicate coatings or other protection against corrosion. Submittals in accordance with Section 01340, Shop Drawings, Project Data, and Samples.
- C. Setting diagrams, erection plans, templates and directions for installation of backing plates, anchors, and other such similar items.
- D. Material compliance certification with standards designated.

##### **1.4 REFERENCE STANDARDS**

- A. Aluminum Association
  - 1) AA 5052 - Aluminum Sheet and Plate, Rolled Rod and Bar and Drawn Tube
  - 2) AA 6061 T6 - Aluminum Sheet and Plate

- 3) AA 6061 T5 - Aluminum Extruded Shapes
  - 4) AA 6063 T6 - Aluminum Extruded Pipe
  - 5) AA 5005 - Sheet and Plate
  - 6) Finishes
    - a) AA M31 - Mechanical Finish, Fine Satin
    - b) AA C22 - Chemical Finish, Medium Matte
    - c) AA A41 - Clear Anodic Coating, Class I
- B. American Iron and Steel Institute (AISI)
1. AISI, Type 316 Stainless Steel Bolts, Bars and Shapes
  2. AISI, Type 316 Stainless Steel Plate and Sheet
- C. American National Standards Institute (ANSI)
- 1) ANSI A14.3 - Safety Requirement for Fixed Ladders
- D. American Society for Testing and Materials (ASTM)
- 1) ASTM A36 - Specification for Structural Steel
  - 2) ASTM A48 - Specification for Gray Iron Castings
  - 3) ASTM A53 - Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless
  - 4) ASTM A123 - Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel Products
  - 5) ASTM A153 - Specification for Zinc Coated (Hot Dip) on Iron and Steel Hardware
  - 6) ASTM A167 - Standard Specification for Stainless and Heat Resisting Chromium - Nickel Steel Plate, Sheet, and Strip.
  - 7) ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

- 8) ASTM A276 - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
  - 9) ASTM A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners
  - 10) ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless Pipe.
  - 11) ASTM A325 - Specification for High-Strength Bolts for Structural Steel Joints
  - 12) ASTM A366 - Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
  - 13) ASTM A611 - Specification for Steel, Cold-Rolled Sheet, Carbon, Structural
  - 14) ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - 15) ASTM B26 - Standard Specification for Aluminum-Alloy and Castings.
  - 16) ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - 17) ASTM B211 - Standard Specification for Aluminum-Alloy Bar, Rod, and Wire.
  - 18) ASTM B221 - Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
  - 19) ASTM B241 - Standard Specification for Aluminum Alloy Seamless Pipe and Seamless Extruder Tube.
  - 20) ASTM B429 - Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
- E. American Welding Society (AWS)
- 1) AWS "Structural Welding Code", D1.1
  - 2) AWS Specification for Arc Welding (Type E70XX) Welding Rods for Steel

- F. ASME International (ASME)
  - 1) ASME B18.2.1 Square and Hex Bolts and Screws Inch Series
- G. SSPC: The Society of Protective Coatings (SSPC)
  - 1) SSPC – Paint 20 – Paint Specification No. 20 Zinc-Rich Primers (Type I, “Inorganic” and Type II, “Organic”)
- H. National Fire Protection Association (NFPA)
  - 1) 101 Life Safety Code

### **1.5 QUALITY ASSURANCE**

- A. The work of 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.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Identify and match-mark all materials, items and fabrications, for installation and field assembly.
- B. Deliver items to job-site as complete units, wherever practicable, ready for installation or erection, with all anchors, hangers, fasteners and miscellaneous metal items required for installation.
- C. Carefully handle and store materials, protected from weather, rusting and other damage.
- D. Store structural shapes, pipes, tubes and sheets off the ground on suitable supports, with webs or flanged shapes vertical.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

#### **A. Steel Shapes and Plates**

- 1) Steel: ASTM A36
- 2) Nuts, Bolts, Rivets, Washers, and Anchorage Devices: ASTM A325 and AISC Specification referenced under Part 1.
- 3) Steel Sheets: Cold-rolled or hot-rolled carbon steel, ASTM A366, or ASTM A569.
- 4) Steel Pipe: ASTM A53, Standard Specifications for Pipe, Steel, Black and, Zinc-Coated, Welded and Seamless; Type S, Grade B, Schedule 40, black finish.

#### **B. High-Strength, Low Alloy Corrosion - Resistant Steel:**

- 1) Plates, shapes, and bars: ASTM A242 or A588.
- 2) Sheet and strip ASTM A606 Type A.

#### **C. Stainless Steel**

- 1) Type 316 unless otherwise indicated or specified.
- 2) Shapes and Bars: ASTM A276.
- 3) Plate, Sheet, and Strip: ASTM A167.
- 4) Tubing: ASTM A269.
- 5) Pipe: ASTM A312, Schedule 40S.

#### **D. Aluminum**

- 1) Plates, rolled or extruded shapes, sheets or castings conforming (unless otherwise permitted or indicated) to Aluminum Association alloy and temper designations.
- 2) Rolled structural shapes and plates 6061-T6.
- 3) Extruded structural shapes 6063-T5.

- 4) Castings 214.
  - 5) Sheets Alclad 3003-H14 and 3003.
  - 6) Bolts and nuts 2024-T4.
  - 7) Pipe railings Schedule 40, ASTM, B241, 6063-T6.
  - 8) Finishes (pipe railings only) - NAAMM Class 1 AA-A41 clear coating.
- E. Fasteners: Provide hot-dip galvanized or stainless steel fasteners for exterior use of where built into exterior walls and pillars. Select fasteners for the type, grade, and class required per the approval of the Engineer. Refer to Paragraph 2.2 for specific material requirements for anchors, bolts, and other fastening devices.
- 1) Bolts and nuts: Regular hexagon head type, ASTM A307, Grade A.
  - 2) Lag bolts: Square head type, FS FF-B-561.
  - 3) Machine screws: Steel, FS FF-S-92.
  - 4) Masonry and concrete anchorage devices: Expansion shields FS FF-S325.
- F. Galvanizing: Provide a zinc coating for those items specified to be galvanized as follows:
- 1) ASTM A153, for galvanizing steel hardware.
  - 2) ASTM A123, for galvanizing assembled steel products.
- G. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC – Paint 20

## **2.2 ANCHORS, BOLTS, AND FASTENING DEVICES**

- A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith. Anchor bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.
- B. Bolts, anchor bolts, nuts, screws, washers, and related appurtenances specified to be stainless steel shall be Type 316 stainless steel unless noted otherwise.
- C. Expansion bolts shall be stainless steel unless otherwise specified.



- D. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANS B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form I).
- E. Bolts, anchor bolts, nuts, and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with ASTM A123, or ASTM A153, as is appropriate.
- F. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and be set in the concrete forms with suitable sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

### **2.3 ALUMINUM ACCESS HATCH**

- A. The aluminum access hatch shall be cast into the wet well slab flush with the surface.
- B. The hatch shall be an angle framed access cover with double leaf construction and a 300 pound per square foot minimum load rating.
- C. The hatch shall be constructed of a 1/4 inch extruded aluminum frame and 1/4 inch aluminum tread plate cover and reinforcing as required to meet the load rating.
- D. The hatch shall include a recessed lifting handle which lies flush with the door surface and a stainless steel staple which may be used to secure the door with a padlock when closed.
- E. The hatch shall have T-316 stainless steel hinges with tamper proof fasteners and attaching hardware.
- F. The hatch shall have a T-316 stainless steel and aluminum positive locking hold open arm with release handle and stainless steel compression spring assist.
- G. The door shall open a minimum of 90 degrees so as to not impede the clear area of the hatch.
- H. The hatch shall include a built-in neoprene cushion/gasket.

- I. The portion of the frame in contact with the concrete shall receive a protective bituminous coating.
- J. The hatch shall include a manufacture's lifetime warranty
- K. The aluminum access hatch shall be series S2S by Halliday Products, or equal.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Anchorage: Provide anchorage for fastening work securely in place. Set anchors in concrete as the work progresses and space not more than 2 feet on centers unless indicated otherwise. Sizes, kinds, and spacing of anchors not indicated or specified shall be as necessary for the purpose, as approved. Anchorage not otherwise specified or indicated includes slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Provide inserts of suitable and approved types where required for support or anchorage of equipment and finish construction.
- B. Fastenings: Do not use wood plugs in any material. Use nonferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, and harmonizing with the material to which fastenings are applied. Conceal fastenings where practicable. Drill and punch to produce clean true lines and surfaces. Countersink metal work to receive hardware.
- C. Threaded Connections: Make threaded connections tight so that threads are entirely concealed. Make bolted work tight and nick the threads or bush the stem to prevent loosening. Abutting bars shall be shouldered and headed, de-welled and pinned. Pass small bars through larger bars and pin. Rivet, bolt, and screw heads shall be flat and countersunk in exposed work and elsewhere as required. Carefully machine removable member and fit and secure by means of screws or bolts of proper size and approved spacing.

### **3.2 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 sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel

or cast iron shall be steel, unless otherwise specified. Threshold 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 for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the Engineer. 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 otherwise specified, 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.
- G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter before shipment and shall be given 1 shop coat of primer compatible with finish coats specified in Section 09941 - Field Painting 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.
- H. 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 according to ASTM A653. 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 ounces per square foot of surface.
- I. Zinc coating, which has been burned by welding, abraded, or otherwise damaged, shall be cleaned and repaired after installation. The damaged area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of SSPC – Paint 20. The paint shall be properly compounded with a suitable vehicle in the ratio of 1 part zinc oxide to 4 parts zinc dust by weight.

### **3.3 INSTALLATION**

- A. Install all items furnished except items to be embedded in concrete, which shall be installed under Division 3. Items to be attached to concrete or existing 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. Where aluminum contacts a dissimilar metal, apply a protective paint as specified in Section 09941 – Field Paints and Coatings. Apply protective paint to both the aluminum metal components and to the dissimilar metal(s).
- C. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.
- D. Where items are cast into concrete, backpaint contact areas before setting.

**END OF SECTION**

**DIVISION 09**  
**FINISHES**

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**SECTION 09703**

**WET WELL PROTECTIVE LINER REPAIR**

**PART 1 GENERAL**

**1.01 DESCRIPTION**

- A. The Contractor shall furnish all labor, materials, and equipment for the repair of the existing Wet Well protective liner where it has been removed or compromised during construction at Master Lift Station (MLS) Tara #20 by cleaning, stopping infiltration, as necessary, and installing a cured in place fiberglass liner system where required. The repair material shall match the existing liner material to ensure compatibility and performance. The existing liner is PerpetuWall Liner System (PLS-650) manufactured by Protective Liner Systems, Inc. (PLS).
- B. Limits of work shall be as shown and described on the drawings.

**1.02 RELATED WORK**

- A. Section 01600 – Materials and Equipment
- B. Section 02770 – Bypass Pumping
- C. Section 03310 – Concrete Work

**1.03 SUBMITTALS**

- A. In accordance with Section 01340, Shop Drawings, Project Data, and Samples, copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer. Submittals shall include the following:
  - 1. Manufacturer's current printed recommendations and product data sheets for products supplied under this section including performance criteria, surface preparation and applications, and safety requirements.
  - 2. Material Safety Data Sheets (MSDS) for any materials brought on-site including all resurfacing and liner system materials, solvents, and abrasive blast media.
  - 3. Storage requirements including temperature, humidity, and ventilation for repair and liner system materials.

4. Manufacturer's requirements, including application procedures for resurfacing materials and liner materials, shall be in writing and shall be followed in detail. All safety precautions recommended by the Manufacturer shall be strictly adhered to at all times when work is in progress.
5. If installation is not be performed by the liner manufacturer, other installer must be certified by manufacturer. Submit manufacturer's certification of installer.

#### **1.04 QUALITY ASSURANCE**

- A. To insure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, one supplier/manufacturer. Installation of the Liner System shall be performed by the liner manufacturer, or other installer that is certified by the liner manufacturer.
- B. Do not use or retain contaminated, outdated, or diluted materials. Do not use materials from previously opened containers.
- C. Make available all locations and phases of the work for access by the Engineer or other personnel designated by the Engineer. The Contractor shall provide ventilation and egress to safely access the liner work areas for inspection.
- D. Conduct work and inspect continually to ensure that the liner systems are installed as specified herein. The Contractor shall inform the Engineer of the progress and the quality of the work. Any nonconforming work shall be corrected as specified herein or as recommended by the Manufacturer.

#### **1.05 DELIVERY AND STORAGE**

- A. Materials shall be stored in accordance with Manufacturer's recommendations in an area or areas designated solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of debris before authorized disposal, to these areas. Protect all other concrete and metallic surfaces and finishes from any spillage of material(s) within the mixing area.
- B. Deliver all materials to the jobsite in their original, unopened containers bearing manufacturer's name and label.
- C. Do not use or retain contaminated, outdated, prematurely opened, diluted materials, or materials which have exceeded their shelf life.
- D. The Contractor shall take all precautions and implement all measures necessary to avert potential hazards associated with all materials as described on the pertinent Material Safety Data Sheets or container labels.

- E. Do not use floor drains, plumbing fixtures, dikes, or storm drains for disposal of resurfacing system materials.

**1.06 SAFETY**

- A. The installer shall follow OSHA regulations, especially those regarding Confined Space Entry, Fall Protection, Respiratory Protection, and Personal Protective Equipment.
- B. The Contractor shall provide personnel with all safety equipment necessary to protect them during any phase of the work. This shall include, but not be limited to, safety glasses, goggles, earplugs, hard hats, steel toed work shoes, appropriate personal protective clothing, gloves, and dust masks.

**1.07 WARRANTY**

- A. The fiberglass-reinforced liner manufacturer shall warrant the liner system against defects for at least five (5) years from the date of acceptance by Owner. Defects are defined as cracking, delamination, or leaking. The warranty shall require the installer to supply all labor, materials and equipment to repair such defects to the satisfaction of Owner. The Contractor / manufacturer / installer shall not make any exemption or exception to the above stated conditions or warranty.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. The liner repair material shall match the existing liner material to ensure compatibility and performance. Repair of the MLS Tara #20 Wet Well protective liner shall be by the PerpetuWall Liner System (PLS-650) as manufactured by Protective Liner Systems, Inc. (PLS).
- B. The protective liner shall be a cured in place fiberglass cloth and epoxy liner. The liner shall be completely watertight and free of any openings other than the pipe inlets, pipe outlets and the access opening. The completed system shall provide a waterproof, corrosion-resistant liner to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gasses/acids produced by wastewater and shall prevent infiltration.
- C. Additional products will be used as necessary to prepare the concrete substrate for the liner system.



**2.02 PROTECTIVE LINER MATERIALS**

- A. The liner shall be composed of a fiberglass cloth encapsulated by a modified epoxy, that is hand-applied.
- B. The reinforcing fiberglass fabric (PLS-818 or 811) shall be Type E glass (electrical grade) having a tensile strength of 500,000 psi, a modulus of elasticity of 10.5 million psi and a maximum elongation of 4.8%. The fabric will have chemical binder to enhance adhesion.
- C. The fiberglass-reinforced liner shall be composed of fiberglass fabric, encapsulated by the Epoxy Coating (PLS-613) and/or Epoxy Mastic (PLS-614). The modified epoxy resin system, the Epoxy Coating and Epoxy Mastic, shall be Bisphenol "A" epoxy resins cross-linked with a modified polyamid curing agent. These resin systems shall be 100% solids formulations emitting no toxic odors. These systems shall be capable of bonding to cleaned brick, concrete, steel, aluminum and galvanized steel in dry, wet or underwater conditions. They shall be capable of bonding to PVC and polyethylene in dry conditions.
- D. The cured liner system's physical properties shall meet or exceed the following:

<b>PROPERTY</b>	<b>TEST METHOD</b>	<b>RESULTS</b>
Hardness	ASTM D-2240-75	72 Shore D
Tensile strength	ASTM D-63860	29,200 PSI
Compressive strength	ASTM D-69554	16,800 PSI
Flexural strength	ASTM D-79058T	343,000 PSI
Ultimate Elongation	ASTM D-63860	4.50%
Bond	ASTM D-4541 (Concrete)	Substrate Failure
Flexural modulus	ASTM D-790	1,590,000 PSI
Shear Strength	ASTM D-2344	4,060 PSI

Color: Gray  
VOC: None  
Cure time: Approx 4 hours at 70°F  
Typical Installation Thickness: 125-180 mils

**2.02 ADDITIONAL PRODUCTS**

- A. Concrete surfaces shall be repaired or rebuilt with a fast-setting, high early-strength cementitious product such as Reliner MSP by Standard Cements, Redline by Tamms, Ince, or equal.
- B. For Infiltration. The stopping of active hydrostatic infiltration shall be accomplished by fast setting cements, plugs and/or powders as manufactured by Tamms, Inc., or

pre-approved equal. Chemical grouts as manufactured by 3M, Avanti or approved equals also may also be used

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. The installation of the approved fiberglass-reinforced liner system shall be in strict conformance with the manufacturer's instructions. This shall include the preparation, application, curing and finishing operations required for the completion of the lining process.
- B. The Contractor shall be responsible for any lighting or ventilation required.
- C. The existing liner shall be protected during all construction activities. Any damage to the liner shall be repaired at the Contractor's expense and to the satisfaction of the Owner.

### **3.02 DEMOLITION**

- A. During demolition activities, the existing liner shall be protected. Where the wet well wall is to be removed, the liner shall be cut per the liner manufacturer's instructions to prevent damaging the liner adjacent to the demolished area.

### **3.03 CLEANING**

- A. Pressure wash (3,500 psi) to remove all dirt, grease, sand, and surface contaminants. All debris and water shall be removed to facilitate a thorough inspection of the existing liner.
- B. Condition of the wet well may require the use of an acidic or alkaline solution or a detergent over the surfaces to be lined. If one of these is used, the surface shall be neutralized and thoroughly rinsed prior to the installation of the liner system.

Neutralization shall be verified by measuring the pH of the concrete substrate using pH indicating papers. pH testing is to be performed once every 50 sq. ft. Acceptable pH values shall be between 8.0 and 11.0 as measured by a full-range (1-12) color indicating pH paper with readable color calibrations and a scale at whole numbers (minimum). Use Hydrion Insta-Check Jumbo 0-13 or 1-12 or equal. The paper shall be touched to the surface once using moderate gloved finger pressure. The surface shall not be wiped or moved laterally to disturb the surface during pH testing. Following the one touch, lift the paper vertically to not "wipe" the surface. Compare the color indicated with the scale provided and record the pH.

**3.04 SURFACE PREPARATION**

- A. All wet well concrete surfaces with deterioration (rough areas, pitting, voids, cracks, etc.) shall be patched and reshaped. This shall be done using a manufacturer-approved, fast-setting, high early-strength cementitious product.
- B. Any water infiltration not stopped by the mudding application during the surface preparation shall be stopped by applying a manufacturer -approved, very fast setting powder or chemical grout designed specifically for direct application to the weeping area.
- C. Surfaces not to be coated shall be protected from liner repairs.

**3.05 LINER INSTALLATION**

- A. Inspect the surface of the host structure for suitability, ensuring that all leaks have been stopped, all voids have been filled and the surface is clean.
- B. The edges of the existing liner shall be kerfed per the manufacturer's recommendations to ensure a secure bond between the existing and new liner.
- C. A layer of Epoxy Mastic shall be applied approximately 100 mils thick by hand. The layer should be uniform and smooth. The individual conducting the installation shall determine the area of epoxy applied. At no time shall the epoxy be allowed to cure before all steps are completed. At all times a "wet" uncured edge must be maintained until installation is complete.
- B. The fiberglass fabric shall be cut to the required dimensions and pressed, using a putty knife, into the mastic to achieve full wetting of the fabric. With subsequent applications of the fabric, the edges shall be either overlapped or butt-joined, at the discretion of the applicator.
- C. A second layer of epoxy either mastic or coating shall then be applied to the top of the fiberglass cloth completely encapsulating it in epoxy.
- D. To maintain a monolithic structure, only a butt joint that uses a 4 inch wide cap strip that is encapsulated in epoxy over the already encapsulated fiberglass cloth or an overlap joint where the sheets of fiberglass cloth overlap each other by a minimum of 1.5 inches shall be used.

**3.06 CURING**

- A. The liner shall be allowed to cure until the surface has set up and resists compression by hand before fluid is allowed to flow over the liner, this to prevent the liquid from eroding the curing epoxy.

- B. The liner shall not be exposed to loads until properly cured, 4 hours for all loads and 24 for loads over 200 pounds (20psi ground pressure)
- C. The epoxies will cure in three to four hours, at 70°F, to approximately 75% of their strength, after which time the wet well may be returned to service. The epoxies will achieve maximum physical properties in four to five days. Higher temperatures will reduce these time requirements. Lower temperatures will increase the time.
- D. However, the wet well may not be returned to service until the Engineer has inspected and approved of the installation and the remainder of the pump station improvements are ready for service as intended.

**3.07 INSPECTION**

- A. Upon completion of the liner system installation, the coated surface shall be cleaned and prepared to permit close visual inspection by the Engineer or the Engineer's representative. Any and all deficiencies or defective work (not in compliance with this section or related sections) will be marked for repair or removal/replacement by the Contractor at no additional cost to the Owner.
- B. The Contractor is ultimately responsible for the quality performance of the applied materials and workmanship. Inspections by the Engineer or the Engineer's representative do not limit this responsibility.
- C. Perform a final inspection to determine whether the liner system work meets the requirements of the specifications. The Engineer and the Engineer's representative will conduct final inspection with the Contractor.

**3.08 CLEANUP**

- A. Upon completion of work, the Contractor shall remove surplus materials, equipment, protective coverings, and accumulated rubbish, and thoroughly clean all surfaces and repair any work-related damage.

**3.09 MANUFACTURERS REPRESENTATIVE**

- A. If an installer other than the manufacturer is used, the contractor shall retain the services of the liner manufacturer to provide periodic inspection during the surface preparation and liner application work. The manufacturer shall provide written notice to the engineer that the concrete repair material and protective liner system has been properly applied.

**END OF SECTION**

**SECTION 09941**

**FIELD PAINTING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION OF WORK**

- A. Appropriate paint type and color shall be purchased for the rehabilitation of MLS Tara #20: new ductile iron piping; new black steel fuel piping system; and bollards. Paint for items located in the valve vault shall be suitable for submersion and exposure to raw sewage.
- B. The wet well liner patches shall be per specification Section 09703, Wet Well Protective Liner Repair.
- C. The bridge crane and monorail hoist systems, including support members, shall be shop painted according to specification Section 14620, Bridge Crane and Monorail Hoist Systems.
- D. Furnish and apply required paints as specified below and in the Drawings.
- E. Prepare, clean, and finish all surfaces specified, scheduled or otherwise indicated to be field painted. The terms "paint" and "coating" used herein include emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as intermediate or finish coats.
- F. Complete painting in accordance with Specifications, and paint manufacturer's current surface preparation and application instructions.

**1.02 RELATED WORK**

- A. Section 02615 – Ductile Iron Pipe and Fittings
- B. Section 05500 – Miscellaneous Metals
- C. Section 09703 – Wet Well Protective Liner Repair
- D. Section 16236 – Emergency Generator Systems

### 1.03 REFERENCES

- A. ASTM (American Society for Testing and Materials)
  - 1) ASTM C 920 - Specification for Elastomeric Joint Sealants.
  - 2) ASTM D 3960 - Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
  - 3) ASTM D 4259 - Practice for Abrading Concrete.
  - 4) ASTM E 337 - Standard Practice Test Method for Measuring Humidity with a Psychrometer.
  - 5) ASTM D 4285 - Standard Test Method for Indicating Oil or Water in Compressed Air
  
- B. ICRI (International Concrete Restoration Institute)
  - 1) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
  
- C. NACE International
  - 1) Pub 6D-173 - "A Manual for Painter Safety"
  - 2) Pub 6G-164 - "Surface Preparation Abrasives for Industrial Maintenance Painting"
  - 3) NACE RP0188 - Standard Recommended Practice, Discontinuity (Holiday) Testing of Protective Coatings.
  
- D. SSPC: The Society for Protective Coatings
  - 1) Paint Application Specifications PA 1-64, No. 1 Shop, Field and Maintenance Painting.
  - 2) SSPC-PA-3 - "A Guide to Safety in Paint Application"
  - 3) SSPC-Guide 12 - Guide for Illumination of Industrial Painting Project.
  - 4) SSPC-SP1 - Surface Preparation: Solvent Wipe
  - 5) SSPC-SP2 - Surface Preparation: Hand Tool Cleaning
  - 6) SSPC-SP3 - Surface Preparation: Power Tool Cleaning
  - 7) SSPC-SP6 - Surface Preparation: Commercial Blast Cleaning
  - 8) SSPC-SP7 - Surface Preparation: Brush off Blast Cleaning
  - 9) SSPC-SP10 - Surface Preparation: Near White Blast Cleaning
  - 10) SSPC-SP11 - Surface Preparation: Power Tool Cleaning to Bare Metal
  - 11) SSPC-SP12 - Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating
  - 12) SSPC-SP13 - Surface Preparation of Concrete
  - 13) And other surface preparation standards as recommended by the paint system manufacturer for the specific application intended.

- E. OSHA (Occupational Safety & Health Administration)
  - 1) 1915.35 - Standards – 29 CFR – Painting
- F. ANSI (American National Standards Institute)
  - 1) ANSI/ASC 29.4 Exhaust Systems - Abrasive Blasting Operations – Ventilation and Safe Practice

#### **1.04 SUBMITTALS**

- A. To aid in determining painting system acceptability and coating compatibility, submit following:
  - 1) List of coating products proposed, giving brand, type and manufacturer. Include complete manufacturer data sheets for individual paints and the painting system.
  - 2) Manufacturer's current printed surface preparation and application recommendations and product data sheets for each.
  - 3) Material Safety Data Sheets (MSDS) for any materials brought on-site including all resurfacing system materials, solvents, and abrasive blast media.
  - 4) Storage requirements including temperature, humidity, and ventilation for resurfacing system materials.
  - 5) Field painting applicator's correspondence for determining compatibility of field coatings with primers and for selecting manufacturer producing field coats.
- B. During Shop Drawing review, submit manufacturer's catalog of color chips and finishes for materials proposed. Owner shall select colors and finish from manufacturer's full range.

#### **1.05 PAINT STORAGE AND MIXING AREAS, AND WASTE DISPOSAL**

- A. Store paints and painter's materials only in area or areas designated solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris before authorized disposal, to these areas.
- B. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.

- C. Transport water to paint area by approved temporary hose or piping.
- D. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in painter's area longer than 24 hours.

#### **1.06 DELIVERY, HANDLING, STORAGE, PROTECTION**

- A. Deliver materials to painter's area in original, unbroken, containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated, outdated, prematurely opened, or diluted materials.
- B. Store coated items carefully. Avoid damaging or dirtying coatings, by contact with soil, pavement or other harmful contacts, which might necessitate special cleaning. Use suitable blocking during storage.
- C. Do not expose primed surfaces to weather for more than six months before top coating. Allow less open time if recommended by coating manufacturer.
- D. During surface preparation, cleaning and painting operations, protect all surfaces not to be painted.
- E. Protect coated items, whether primed or finished, from damage due to shipping and handling.
- F. Upon completion of field painting, ensure coatings are undamaged and in good condition. Make good damage or coating deterioration resulting from failure to observe foregoing requirements.

#### **1.07 SAFETY**

- A. The Contractor's work forces should comply with the provisions outlined in the following documents:

SSPC-PA-3 "A Guide to Safety in Paint Application"

NACE Pub. "A Manual for Painter Safety"

- B. The Contractor shall provide personnel with all safety equipment necessary to protect them during any phase of the work. This shall include, but not be limited to, safety glasses, goggles, earplugs, hard hats, steel toed work shoes, appropriate personal protective clothing, gloves, and plant approved escape respirators (where required).
- C. Keep any flammable materials such as cleaning solvents, thinners, or resurfacing materials away from open flames, sparks or temperatures higher than 150°F. Drums containing flammable materials will be grounded. No solvent in any quantity shall



be allowed inside containment enclosures or permitted confined spaces at any time during resurfacing work.

- D. Power tools are to be in good working order to avoid open sparking. No spark producing tools shall be utilized in restricted areas as indicated herein.
- E. The Contractor shall fireproof all work areas by maintaining a clean work area and having Underwriter's Laboratories approved fire extinguishers on-hand. The Contractor shall furnish these fire extinguishers.
- F. Workers doing abrasive blasting operations shall wear a fresh air supplied protective helmet and hood and personal protective clothing acceptable to industry standards and all government regulations.
- G. Dispose of rags used for wiping up resurfacing materials, solvents, and thinners by drenching them with water and placing in a metal container with a tight fitting metal cover. Complete this disposal process at the end of each day. Final disposal of these materials is the Contractor's responsibility.
- H. Matches, smoking, flames, or sparks resulting from any source including welding, must be remote from the work area during coating work. Smoking is permitted only in designated areas of the plant.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS - GENERAL**

- A. Paint Coatings: Ready-mixed paints, both exterior and interior, shall be first-line (best quality grade) retail products. Use coatings on ferrous surfaces of protective paint coating quality.
- B. Use products of one manufacturer in any one paint coating system; all coating materials compatible. Coatings for touch-up shall be same as original.
- C. Thinners and additives shall be of types recommended by the paint manufacturer.
- D. The use of lead-containing paint is not permitted.

### **2.02 COLORS**

- A. The finish color for surfaces to be painted shall be selected by the Owner. During Shop Drawing review, the Contractor shall submit manufacturer's catalog of color chips and finishes for materials proposed. The Owner shall select colors and finishes from manufacturer's full standard range.

1. The fuel lines shall be painted OSHA red.
- B. To provide contrast between successive coats, lightly tint each coat to distinguish it from preceding coats.
- C. Unless otherwise indicated, for finish paint use gloss or semi-gloss on metal, and matte finish or flat on masonry and concrete.

**2.03 COATING SCHEDULE**

- A. The following coating schedule was developed by selecting appropriate types of coatings for the various components to be coated. It shall be the Contractor's responsibility to review the following schedule and confirm with the coating supplier the most appropriate coating for the particular application.
- B. Description of coating types includes minimum acceptable percent, by volume, of component solids. Brand identification is keyed to products of Tnemec Co., Inc., Kansas City, MO, to establish standard of quality or approved equal.
- C. Omit primer on items with shop coat primer. All shop coats shall be touched up and allowed to dry before application of finish coats. Contractor shall verify that coatings are compatible with shop primer.

<b>COATING SCHEDULE</b>				
Location, Substrate & Service	Surface Preparation	Coating Name (Generic/Brand), Series Number, Dry Film Thickness (mils)		
		1 <sup>st</sup> Coat	2 <sup>nd</sup> Coat	3 <sup>rd</sup> Coat
Valve Pit  New Exposed Ductile Iron Piping  (With Factory applied asphaltic coating)	Remove asphaltic coating for exposed portion of piping:  Power Tool Cleaning to Bare Metal, SSPC-SP11	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  3.0-5.0 mils DFT	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  6.0-8.0 mils DFT	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  6.0-8.0 mils DFT
Valve Pit  New Exposed (Ferrous) Metals  (Not Shop Primed)	Commercial Blast Cleaning, SSPC- SP6, or Power Tool Cleaning, SSPC-SP3, as appropriate.	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  3.0-5.0 mils DFT	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  6.0-8.0 mils DFT	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  6.0-8.0 mils DFT
Bollards & Fuel Piping System  New Exposed (Ferrous) Metals  (Not Shop Primed)	Commercial Blast Cleaning, SSPC- SP6, or Power Tool Cleaning, SSPC-SP3, as appropriate.	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  3.0-5.0 mils DFT	Polyamidoamine Epoxy  Tnemec Series N69, Hi-Build Epoxoline II  2.0-4.0 mils DFT	Aliphatic Acrylic Polyurethane with factory added UV Blocker (designed for exterior exposure)  Tnemec Series 73U  2.0-3.0 mils DFT

## 2.04 PAINT SCHEDULE

- A. Coordinate, schedule and confirm the various cleaning, touch-up and finishing operations with the owner and the Owner. Ensure the transmission of materials data, color selections and coating system methods between the coating applicators. Take responsibility for not exceeding exposure and re-coat time limits.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Hoisting, Scaffolding, Staging, and Planking:
  - 1. Provide, set-up, and maintain all required hoists, scaffolds, and staging and planking, and perform all access related hoisting work required to complete the work of this section as indicated and specified.
  - 2. Scaffolds shall have solid backs and floors to prevent dropping materials from there to the floors or ground below.
- B. Environmental Requirements:
  - 1. Comply with the Manufacturer's recommendations as to environmental conditions under which resurfacing system materials can be applied.
  - 2. Do not apply resurfacing system materials when dust is in work site.
  - 3. The Contractor shall provide all temporary lighting during the work.
- C. Protection:
  - 1. Cover or otherwise protect finish work or other surfaces not being resurfaced.
  - 2. Erect and maintain protective tarps, enclosures and/or maskings to contain debris (such as dust or airborne particles resulting from surface preparation) generated during any and all work activities. This includes, but is not limited to, the use of dust/debris collection apparatus as required.
- D. Thinners and Solvents:

The Contractor shall use only solvents and thinners as recommended by the Manufacturer.

### 3.02 INSPECTION

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work.
- B. Do not proceed with surface preparation or coating application until conditions are suitable.
- C. Unacceptable surface conditions are defined for concrete as the presence of cracked surfaces or concrete deteriorated to a depth of greater than 1" or otherwise unable to withstand surface preparation as specified herein.
- D. For steel surfaces, unacceptable surface conditions may include severe loss of structure, or conditions under which the specified surface preparation will damage the steel surface.

### 3.03 PREPARATION

- A. Basic Steps:
  - 1) Arrange to do all preparation and paint work in still, dry air and less than 80° F temperature.
  - 2) Cleaning and resurfacing shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly resurfaced areas.
  - 3) Maintain all coating materials at manufacturer's recommended mixing and application temperatures for not less than 24 hours before use. Have clean, proper containers, spray equipment, applicators and accessory items ready for use before decanting or mixing paint materials.
  - 4) Ensure proper coordination of materials to be applied hereunder with previous coatings on affected surfaces. Have all manufacturer's written directions on hand, and follow them strictly, except where otherwise specified.
- B. Initial Cleaning/Decontamination. Before any paint application, carefully clean all surfaces to be coated of dust, dirt, grease, loose rust, mill scale, paint unsuitable for top coating, efflorescence, oil, moisture, foreign matter or conditions detrimental to coating bond and durability.
  - 1) Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.

- 2) If mechanical cleaning is used, oil and grease shall be removed before starting via an alkaline-based emulsifying detergent as recommended by the resurfacing material manufacturer.
  - 3) When an alkaline-based emulsifying detergent is used, verify that the pH of the cleaned concrete surfaces to be coated is within the range of 8 to 11. Application of coating materials outside this range will not be permitted without written approval from the Engineer.
  - 4) Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded and free of contaminants that might interfere with the adhesion of the resurfacing materials (Reference SSPC-SP13/NACE No. 6).
  - 5) Fill imperfections and holes in surfaces to be painted.
- C. Sound existing coatings may remain, if they cannot easily be removed by the specified methods of surface preparation. The definition of sound coatings is: Coatings that cannot be removed using a dull putty knife. Sound remaining coatings must be scarified prior to overcoating with the specified coating system.
- D. Metals:
- 1) Ferrous metals, including field welds and unprimed shop welds, without shop prime coats as follows:
    - a. Near White blast cleaned (SSPC-SP-10), for Type S service (in contact with process water/wastewater and sludges).
    - b. Commercial blast cleaned (SSPC-SP-6), for Type E service (non-immersed).
    - c. Power tool cleaned (SSPC-SP-3), for Type M and I service (confined areas or in vicinity of equipment)
    - d. Rusted areas cleaned (SSPC-SP-6)
    - e. Needle gun may be used for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface.
  - 2) Ferrous metals with shop primers cleaned as previously specified, then:
    - a. Sanded to a smooth surface before under coating, for Type M or I service.

- b. Prepared to meet manufacturer's recommendations for Type E or S service.
  - c. Building structural steel – Hand tool clean (SP-2) of nuts, bolts, welds, and normal abrasions followed by a touch-up coat of the shop primer material.
- 3) Bituminous coated metals for paint finish; clean of all dirt, grease, oil and foreign matter, and prime with a barrier coat to seal the bitumen and prevent bleeding and discoloration of finish.
- 4) Non-ferrous and galvanized metal surfaces for finish; Clean of all dirt, grease, oil, and foreign substances, wash thoroughly with grease solvent, then permit to dry. If paint will be applied, hand or power sand to abrade surface. Otherwise, apply one coat of vinyl-type wash, meeting Mil. Spec. MIL-P-15328C and apply next coat within 24 hours of wash priming.
- D. Concrete:
- 1. Sandblast walls, remove all oil, release agents, dirt, dust, grease, paint, loose material and foreign matter. Remove latency, roughen smooth surfaces by brush sand blasting, remove fins and projections. All surfaces shall be clean and dry.
  - 2. Repair imperfections and damaged areas with the specified epoxy cement.
  - 3. Fill all voids, bugholes and other surface imperfections with Thnec Series 218 MortarClad, and / or Series 219 MortarCast (per SSPC-SP 13).
  - 4. Allow new mortar to cure for at least 14 days.

### 3.04 TOUCH-UP

- A. Before applying field coat, touch-up abraded areas of shop coats with paint as specified in coating schedule. Apply an entire coat if necessary. Touch-up coats are in addition to, and not a substitute for first field finish coat. Clean deteriorated surfaces to bare metal before applying touch-up coat. Contractor is responsible for verifying that coatings are compatible with shop primer.
- B. Damaged areas of ductile iron piping, fittings, and valves will be prepared by removing all contaminants and rust by Power Tool Cleaning (SSPC-SP3). Spot field surface preparation must not “polish” to steel surface. Surface must be properly “profiled” before application of any coatings. After preparation, damaged areas shall be primed as specified in coating schedule.

- C. Equipment, motors, pumps, instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer; after installation, touch-up all scratches and blemishes before applying field coats.

### 3.05 APPLICATION

- A. In general, apply minimum of one touch-up primer coat and one finish coat to all previously primed surfaces. The dry film thickness of each coat shall not be less than the manufacturer's minimum thickness for the specific application and painting system used. This requirement shall be strictly complied with and shall be routinely checked by the Contractor. Following careful inspection of surfaces not previously primed, prepare and clean as specified, apply proper prime coat and minimum of one primer coat and one finish coat. Refer to Paint Schedule.
- B. Areas not to be coated shall be masked to prevent these surfaces from being oversprayed.
- C. Conditions:
  - 1) The Contractor must follow the minimum and maximum recoat limitation times and related temperature range restrictions between successive lifts for all products specified herein per Manufacturer's stated requirements.
  - 2) Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing. Avoid painting of surfaces while they are exposed to the sun.
  - 3) Paint surfaces which have been cleaned, pre-treated, or otherwise prepared for painting with first field coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.
  - 4) Coat blast cleaned metal surfaces immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.
- D. Methods:
  - 1) Spraying with adequate apparatus may be substituted for brush and roller application of suitable paints and in locations suitable for spraying. So long

as the minimum dry thickness and all other recommendations of the manufacturer as to application are complied with.

- 2) Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations, except where specifically directed otherwise. Control temperature of materials upon mixing and application, surface temperature and condition, thinning and modifying.
- 3) Protect surfaces to be coated, before, during and after application unless ambient weather conditions are favorable.

E. Workmanship:

- 1) Spot prime with aluminum paints, all exposed nails and other ferrous metal on surfaces to be painted with water-thinned paints.
- 2) Apply coating materials to meet manufacturer's spreading rate and dry film thickness recommendations. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.
  - a) Control thinning for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.
  - b) Record quantities of materials of each type, for each coat, used in each location.
- 3) Apply paints and coatings using skilled painters, brushed and/or rolled out carefully to a smooth even coating without runs or sags. Flow enamel evenly and smoothly. Allow each coat of paint to dry thoroughly, on the surface and throughout the film thickness, before the next coat is applied. High polymer coatings may be excepted from the drying requirement if recoat time is specified by manufacturer.
- 4) Finish surfaces: Uniform in finish and color, and free from flash spots and brush marks.
- 5) Accessory items, finish hardware, lighting fixtures, escutcheons, plates, trim and similar finish items not to be painted: Remove or carefully mask before painting adjacent surfaces. Carefully replace and reposition upon completion of adjacent painting and cleaning work.



**3.06 PROTECTION AND CLEAN-UP**

- A. Protect all materials and surfaces painted or coated under this section, both before and after application. Also protect all adjacent work and materials by the use of sufficient drop cloths during the progress of this work. Upon completion of the work, clean up all paint spots, oil, and stains from floors, glass, hardware, and similar finished items.

**END OF SECTION**

**DIVISION 11**  
**EQUIPMENT**

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**SECTION 11201  
COPLASTIX SLUICE GATES**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK:**

- A. The work to be performed under this Section shall include furnishing all labor, materials, tools and equipment necessary to install and test all sluice gates, consisting of, but not limited to frames, discs, seals, stems, operators, floor stands, stem guides, anchorage, and all other appurtenances, in place and complete, as manufactured by Ashbrook Corporation, Houston, Texas, or equal.
- B. All gates 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. The equipment shall include, but is not be limited to, the following Schedules:

Sluice Gate Schedule					
Qty.	Location	Type	Size (WxH) (ft)	Mounting	Seating Head (ft)
2	Flow Splitter Box	Sluice – Down Closing	2 x 2	Face-Mount	<10

**1.02 RELATED WORK**

- A. Section 01340 - Shop Drawings, Project Data and Samples
- B. Section 03010 - Concrete Work
- C. Section 05500 - Miscellaneous Metals

**1.03 SUBMITTALS:**

- A. Materials and Shop Drawings:
  - 1. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer. Submittals shall include the following:
    - a. Certified shop and erection drawings and data regarding sluice gates.

- b. Literature on drawings describing the equipment and showing all-important details of construction and dimensions.
- B. Operating Instructions: Operating and maintenance instructions for each type of sluice gate shall be furnished to the Engineer.
- C. Installation: The manufacturer shall provide installation instructions. The installation and adjustment of gates, operators and all accessories shall be in full accordance with these instructions. The sluice gates shall be installed by the best practices and methods.

**1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING:**

All equipment shall be delivered in suitable packaging, cases, or crates and stored or placed in the appropriate manner. Each package shall have an identifying mark and a complete list showing contents.

**1.05 APPLICABLE PUBLICATIONS:**

The following publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS. D635-81 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position D648-82 Test Method for Deflection Temperature of Plastics Under Flexural Load NASA CR-1457, "Manual for Structural Stability Analysis of Sandwiched Plates and Shells" et al.
- B. AMERICAN WATER WORKS ASSOCIATION (AWWA) C501-87 Standard for Cast Iron Slide and weir Gates.

**1.06 WARRANTY AND GUARANTEE:**

The Manufacturer shall guarantee the sluice gates, when installed and operated as recommended by the Manufacturer with a documented maintenance program, trouble-free operation for a period of ten (10) years. If the Owner or Engineer is not completely satisfied with the performance of the product, the Manufacturer shall remedy the problem at no cost or refund the materials and installation cost upon the return of the equipment. The Manufacturer shall guarantee the following:

- A. Leakage shall be no more than that allowed by the AWWA C501 Standard during the guarantee period.

- B. Door (disc) shall be free of sticking or binding as judged by the Engineer (move freely via operator provided) with no exercising required. Gate operators are to be warranted by the operator manufacturer.

**1.07 OTHER:**

- A. All gates shall be fully assembled in their frames except for operators, guides, stem-extension, and stem covers or concrete-mounted pedestals. Where shipping constraints require it, frame may be partially assembled such that the top may be easily mounted to the bottom containing the disc.
- B. Where square-to-circular or bell-lip conversion is required the Contractor shall provide a bell-end pipe insert of suitable diameter and water stop.
- C. J. Bulb seals attached to the Disc / mounted to the frame, or any seal that needs replacement in less than 10 years shall not be acceptable. No part of the seal shall protrude into the clear opening.
- D. All sluice gates shall be supplied by the same manufacturer, who shall be fully experienced, reputable and qualified in the manufacturing of the equipment furnished and who has been building said equipment for a minimum period of ten (10) years.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS:**

Sluice gates shall be designed for the seating and unseating heads as listed in the gate schedules. Sluice gates shall conform to the AWWA C501. Conformance to AWWA C501 applies to discs and frames with a safety factor of five (5) with regard to tensile, compressive and shear strength and with the requirement that all gates will yield no more leakage than shown in Section 6.8 (AWWA) Field Leakage Test. Calculations shall be submitted to show conformance. Materials of construction shall be suitable for the environment in which the sluice gates shall be installed and operated.

- A. Reinforced Plastic Sluice Gates – General: 316L Stainless Steel frames, reinforced plastic slide (disc) as specified herein. FRP, GRP, plastic coated steel or externally reinforced slide (disc) shall not be acceptable.
- B. Slide (Disc): Shall be constructed from a reinforced rigid composite plastic material, having a minimum thickness of 1/8-inch. Slide (disc) shall have an internal matrix of carbon steel of suitable strength for the specified service. The slide (disc) outer surface skins shall be a homogeneous plastic material having extremely high tensile and impact strength, be nontoxic and shall be stabilized

against ultraviolet light. The plastic material shall be an Aramid fiber from the KEVLAR family of fibers, and shall have the following minimum properties and shall be designed to limit the deflection to a maximum of 1/1000 of the span under design head conditions based upon horizontal support members only. Manufacturer shall submit drawings and comprehensive design criteria to substantiate that the required deflection figure for each door has been achieved. Comprehensive safety factor calculations shall include bending moments, buckling stress, and bonding stress with thermal expansion factors suitable for reference in NASA CR-1457, "Manual for Plates and Shells". et al. Safety factors shall be calculated for the disc under maximum head, and shear at the disc/seal interface. No substitute of fiber type will be acceptable.

PROPERTIES TABLE

Tensile Strength	12,500
Young's Modulus	1,200,000 psi
Flexural Strength	18,000 psi
Flexural Modulus	1,400,000 psi
Compressive Strength	11,000 psi
Impact Strength	40.3 x 10 <sup>6</sup> erg
Water Absorption	0.38 %
Specific Gravity	1.72
Coefficient of Thermal Expansion	1.6 x 10 <sup>-5</sup> per C
Heat Distortion Point	80 degrees C ASTM D648
Low Temperature Impact Strength	93% @ -20 C
Notch Sensitivity	Not notch sensitive
Weathering Properties	Excellent
Fire Resistance	Class 1 Spread of Flame, Rating BS476: Part 1: 1953 self-extinguishing, ASTM D635 - 56R
Chemical Resistance	Organics, Alkaline, Ozone (2 to 3 PPM)

Rigid Polyurethane foam shall be used as filler between the steel grid reinforcing system and shall be a min. of 7 LB density/cu.ft.

- C. Seals: The sealing arrangement for the reinforced plastic sluice gates shall comprise of sealing faces and side guides constructed of ultra high molecular weight polyolefin having an extremely low coefficient of friction and backing constructed of highly resilient expanded neoprene. Guides and seating of the gate shall be easily adjustable (min. 5/8-inch). All moving contact surfaces shall be compatible to each other there by minimizing sticking / jamming and making the operation easy. Leakage rates shall be one-half (1/2) that allowed by AWWA C501.

## **2.02 FASTENERS:**

Shall be 316 stainless steel. All anchor bolts, assembly bolts, screws, nuts, etc. shall be of ample section to safely withstand the forces created by operation of the gate while subjected to the heads specified.

## **2.03 STEMS:**

All stems shall be the rising types. The entire stem, including extension stem, shall be Type 316 Stainless Steel. The sections of extension stems shall be joined together by solid couplings, threaded and keyed to the stems. All couplings of the same size shall be interchangeable. Stems shall be furnished with adjustable, polyethylene bushed stem guides, spaced as necessary to maintain a slenderness ratio L/R of less than 200. Stems shall be of ample cross section to prevent distortion and shall have stub acme threads. Stems shall be designed to withstand tensile and compressive loads that occur under maximum operating conditions. Design for compressive loading shall meet AISC code where  $K=1$  with a minimum safety Factor of 2 to 1. These requirements exceed AWWA standards. Stems shall be cold rolled with a double start stub acme thread and a finish of 32 microns or less. Stems shall be fixed to the disc by a threaded and keyed assembly into a lifting nut attached to the disc in a lifting bracket, which is bolted to the disc.

## **PART 3 – EXECUTION**

### **3.01 INSTALLATION**

Installation of all gates and guides shall be done by the Contractor in a manner acceptable to the Manufacturer and Owner. It shall be the responsibility of the Contractor to handle, store, and install the equipment specified in this Section in strict accordance with the Manufacturer's drawings and recommendations. Frames and guides shall be installed in a true vertical plane with 90-degree corners.

### **3.02 INSPECTION AND TESTING**

- A. Furnish the services of a factory representative for one (1) day who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test run of the equipment.
- B. Maximum gate leakage shall be as defined in the General Design Criteria of this Specification, herein. If gates, operators, and appurtenances do not meet specified requirements, corrective measures shall be taken by the Contractor, or the equipment shall be removed and replaced with equipment that satisfies the conditions specified.

**END OF SECTION**

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**SECTION 11319**

**SUBMERSIBLE PUMPS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals to install four (4) submersible pumps at Master Lift Station Tara #20, tested and ready for operation and with all accessories as shown on the Drawings and as specified herein.

**1.02 RELATED WORK**

- A. Division 2 – Piping, Valves, and Appurtenances
- B. Section 03310 – Concrete Work
- C. Section 05500 - Miscellaneous Metals
- D. Section 09941 - Field Painting
- E. Section 14900 – Monorail and Hoist System
- F. Division 15 - Mechanical
- G. Division 16 - Electrical Work
- H. Section 17010 - Instrumentation

**1.03 SUBMITTALS**

- A. Submit to the Engineer, in accordance with Section 01340, copies of all materials required to establish compliance with this Section. Submittals shall include the following:
  - 1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
  - 2. Descriptive literature, bulletins and/or catalogs of the equipment.
  - 3. Data on the characteristics and performance of the pumps. Data shall include guaranteed performance curves, based on actual shop tests of duplicate units, which show that they meet the specified requirements for head, capacity, efficiency, allowable NPSH, allowable suction lift and horsepower. Curves shall be submitted on 8-1/2-in by 11-in sheets. Curves for variable speed pumps shall be provided



with at least five curves plotted from maximum rpm to minimum rpm.

4. The total weight of the equipment including weight of the single largest item.
5. A complete total bill of materials for all equipment.
6. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc, on the list. List bearings by the bearing manufacturer's numbers only.
7. A statement indicating bearing life.
8. Complete data on motors and power factor correction capacitors.
9. Complete description of surface preparation and shop prime painting.

**B. Operation and Maintenance Data**

1. Copies of an operating and maintenance manual for each size pump shall be furnished to the Engineer as provided for in Section 01730. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc, that are required to instruct operating and maintenance personnel unfamiliar with such equipment.
2. A technical representative, from the respective pump manufacturer, who has complete knowledge of proper operation and maintenance shall be provided for 1 day to instruct representatives of the Owner and the Engineer on proper operation and maintenance. This work may be conducted in conjunction with the inspection of the installation and test run as provided under Paragraph 3.02 below. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no additional cost to the Owner.

**1.04 REFERENCE STANDARDS**

- A. American National Standard Institute (ANSI)
- B. Anti-Friction Bearing Manufacturers Association (AFBMA)
- C. National Electrical Manufacturers Association (NEMA)
- D. National Electrical Code (NEC)
- E. Factory Mutual (FM)
- F. Underwriters Laboratories (UL)
- G. Where reference is made to one of the above standards, the revision in effect at the time

of bid opening shall apply.

### **1.05 QUALITY ASSURANCE**

- A. Multiple pumps of the same type to be furnished under this Section shall be the product of a single manufacturer. The pumps shall be:
  - 1. Tara #20 Wastewater Pumps: Flygt Corp. 8-inch CP3231 / 605 or equal
- B. The rated horsepower of the drive unit shall be such that the unit will not be overloaded nor the service factor reduced when the pump is operated at any point on the pump's capacity curve. If, due to the slope of the pump's performance curve, a drive unit of greater horsepower than specified is required to meet this condition, the pump will be considered for approval only if any and all changes in electrical work, etc, required by such a change will be provided at no additional cost to the Owner and be to the satisfaction of the Engineer.

### **1.06 SYSTEM DESCRIPTION**

- A. All of the equipment included herein is intended to be standard for submersible use in wastewater treatment.
- B. The submersible pumps shall be as follows:
  - 1. Name: Flygt
    - a. Location: Wet Wells
    - b. Number of Units: 4
    - c. Configuration: 2 pumps per wet well
    - d. Capacity and Head: 2,000 gpm @ 100 TDH
    - e. Total Head Minimum Efficiency at Design Capacity: 77%
    - f. Pump Speed at Design Capacity (Maximum): 1185 rpm
    - g. Minimum Solids Size: 3-inch
    - h. Minimum Shut-off Head: 120 feet
    - i. Net Positive Suction Head Available: 36 feet
    - j. Motor Hp: 90
    - k. Motor Type: Submersible

- l. Pump Discharge Size: 8-inch
- m. The motor shall be variable frequency drive compliant as specified in Section 16269. The pumps will be operated at variable speed, controlled separately by the water level in the wet well. The motors shall be submersible squirrel cage induction type.

#### **1.07 MAINTENANCE**

1. One set of all special tools required for normal operation and maintenance shall be provided.
2. The following spare parts shall be provided:
  - a. One extra set of mechanical seals for each pump.
  - b. Two complete sets of gaskets, O-rings, etc, for each pump.
  - c. One set of pump radial and thrust bearings.
  - d. One set of wearing rings.

#### **1.08 FACTORY TESTING**

- A. The pumps shall be factory tested as follows: each pump shall be hydrostatically tested at 100 psig internal pressure and 30 psig external pressure. Motor and cable insulation shall be tested for moisture content and defects before and after the above tests. Manufacturer shall submit written report with the details and results of the tests.
- B. Controls shall be factory tested and documentation of the test shall be submitted.
- C. No equipment shall be shipped until the above test results are received.

#### **1.09 WARRANTY**

- A. The pump supplier shall unconditionally warranty, in writing, the pumps being supplied against defects in workmanship and materials for a period of five (5) years. These warranties shall begin with the acceptance of the Work by the Owner.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS AND EQUIPMENT**

##### **A. General**

1. This Section is intended to give a general description of what is required, but does

not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however intended to cover all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in this Section or not.

2. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this Section or not and as required for an installation incorporating the highest standards for the type of service.
3. Pump bases or base elbows as the case may be shall be rigidly and accurately anchored into position on concrete and all necessary foundation bolts, plates, nuts and washers shall be furnished and installed. Anchor bolts shall be Type 304 stainless steel.
4. Brass or stainless steel nameplates giving the name of manufacturer, the rated capacity, head, and all other pertinent data shall be attached to each pump and each motor. As a minimum, the nameplate for the pump motor shall include: model/serial number, horsepower, voltage, full load amps, full load rpm, phases, frequency, NEMA LRA code, NEMA design, insulation class, ambient temperature, lead connections for direction of rotation, type of duty, type of bearings, and pump impeller size,
5. The manufacturer shall supply complete factory mounted equipment with sufficient power and signal cable, as required by the location.
6. Each pump and drive shall be designed to withstand the maximum turbinning run-away speed of the pump due to backflow through the pump.
7. All electrical materials and equipment shall be UL listed or FM approved and NEMA rated, and shall otherwise be equal to that supplied under Division 16, where applicable.

## **2.02 PUMP CONSTRUCTION**

- A. The pumps shall be totally submersible, solids handling, non-clog, screenless pumps. The pumps specified in Paragraphs 1.06B1 above shall be mounted on a guide rail system to allow the pumps to be easily removed for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose and no need for personnel to enter the pump well. Each pump shall be fitted with a stainless steel lifting chain of adequate strength and length to permit raising the pump for inspection and removal. The pumps shall be pedestal mounted, not anchored to the floor and removable by breaking the discharge piping, which shall include a union for that purpose.
- B. The stator casing, coil casing, and volute shall be constructed of gray iron with all components in contact with liquid protected by a coat of acrylic zinc phosphate primer. All external bolts and nuts shall be of stainless steel.

- C. The impeller shall be of cast iron Class 35B. The impeller shall be protected by a stainless steel wear ring and neoprene O-ring at the inlet of the pump. The impeller shall be of a centrifugal, non-clog design, capable of passing solids, fibrous material and heavy sludge, and constructed with long throughway with no acute turns.
- D. Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped seal faces. Each seal face shall consist of one stationary and one positively driven rotating tungsten-carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces shall not be considered equal to tandem seal specified and required. No seal damage shall result from operating without water, nor shall the sealing system rely on the pumped media for lubrication. The unit shall be designed so that if the outer seal fails, the contaminants that enter shall not enter the bearing housing and cause damage to the bearings.
- E. Pump shafts shall be of stainless steel, ANSI 431 or ASTM A572 isolated from liquid.
- F. Pump and motor bearings shall be anti-friction type with a B-10 life of 100,000 hours minimum.
- G. Each pump shall be provided with a lifting handle, suitable for use with a lifting chain as later specified herein.
- H. For the pumps specified with a guide rail system:
  - 1. Each pump discharge elbow connection shall be permanently installed in the wet well along with the discharge piping. Each pump shall be automatically connected and sealed to its discharge connection elbow when lowered into place and shall be easily removable. Each pump shall be mounted on a sliding guide bracket which is used to guide the pump into place with the discharge connection elbow. The sliding guide bracket and the pump casing shall have a machined angle connection with yoke to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump angle connection without the need of any bolts or nuts. Provide Type 304 stainless steel anchor bolts for attachment to the floor.
  - 2. Sealing of a pumping unit to its discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided to the wedging tightly against the angled discharge connection; no portion of the pump shall bear directly on the sump floor and no rotary motion of

the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing will not be accepted as an equal to a metal contact of the pump discharge and mating discharge connection as specified and required.

3. The lower guide holders shall be integral with the discharge connection. Each pump shall ride on dual guide bars when raised and lowered in the sump. Guide bars shall be of standard weight 3-in stainless steel pipe. The discharge connection elbow shall have a flanged connection to the discharge piping.
  - I. Pump motors shall be housed in an air-filled or oil-filled watertight submersible casing and shall have Class H insulated windings which shall be moisture resistant. The stator shall be copper wound (aluminum stator windings not accepted). Pump motors shall be 460 Volt, 3 Phase, 60 Hz. Motors shall be NEMA Design B. Motor characteristics are specified above. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially, or non-submerged condition. The pump motor shall be capable of running without damage, for extended periods. Pump and motor shall be explosion-proof, suitable for Class I, Division I, Group D applications. Motor shall be provided with pilot thermal sensors embedded in stator windings. The motor shall be variable frequency drive compliant as specified in Section 16269.
  - J. Pump power cable shall be suitable for submersible pump and Class I, Division I, Group D applications. Cable sizing shall conform to NEC standards for pump motors. Cable entry to each pump shall be designed for submersible pump applications. The cable entry junction box and motor shall be separated by a stator load sealing gland or terminal board which shall isolate the motor interior from foreign materials gaining access through the pump top. There shall be no splices in the power supply cable or control cables from the power source to the pump. Provide cable holder as specified herein.
  - K. A multi-conductor submersible cable designed for submersible pump applications shall also be supplied to convey pump monitoring device signals to a monitoring panel provided by the pump manufacturer (MAS 711 by Flygt, or equal).
  - L. The pumps, with their appurtenances and cable, shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65-ft. The pumps shall receive a factory test to determine that each unit operates satisfactorily and that all seals are properly in place, under the above specified submergence conditions.
  - M. All wetted parts shall be shop primed with a PVC epoxy. Exterior of pumps, in addition to above, shall receive a factory applied epoxy finish coat.

## 2.03 PROTECTION

- A. Each pump motor stators shall incorporate three thermal switches, connected in series, to provide over temperature protection of the motor winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm. The stator shall also include one PT-100 type temperature probe to provide for monitoring of the

stator temperature

- B. A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.
- C. Two leakage sensors shall be provided to detect water intrusion into the stator chamber and junction chamber. A Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in either the stator chamber or junction chamber. When activated, the FLS will stop the motor and activate an alarm. Use of voltage sensitive solid state sensors shall not be allowed. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.
- D. The solid-state pump memory unit, three thermal switches, two FLS switches, PT-100 stator temperature monitor and the lower bearing PT-100 temperature monitor shall all be connected to a MAS (Monitoring and Status) monitoring unit. The MAS shall be designed to be mounted in the control panel and shall come with an Operator Panel that is dead-front panel mounted. The MAS Operator Panel shall have soft-touch operator keys and provide local indication of the status of the alarms within the connected pump unit by means of an LCD screen read-out. Local MAS system change shall be made by use of the soft-touch keypad or local connection by means of a laptop computer. Remote indication of pump unit status shall connected to the PLC.

#### **2.04 ACCESSORIES AND APPURTENANCES**

- A. Pump accessories and appurtenances shall include, but not be limited to:
  - 1. Power and control/sensory holder (all wells).
  - 2. Lifting chains (all pumps).
  - 3. Safety chain hooks (all wells).
  - 4. Guide rails.
  - 5. Upper guide bar brackets.
- B. Chain, safety chain hook and cable holder shall be stainless steel.
- C. Provide upper guide bar brackets on the concrete wall to support the pump guide bars.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

### **3.02 START-UP SERVICE**

- A. The equipment manufacturer shall furnish the services of a qualified factory trained field service engineer for two 8-hour working days to inspect the installation and instruct the Owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the Contractor shall have the Manufacturer do the following:
  - 1. Megger stator and power cables.
  - 2. Check seal lubrication.
  - 3. Check for proper rotation.
  - 4. Check power supply voltage.
  - 5. Measure motor operating load and no load current.
  - 6. Check level control operation and sequence.
- B. During this initial inspection, the manufacturer's service representative shall review recommended operation and maintenance procedures with the owner's personnel.

### **3.03 FIELD ACCEPTANCE TESTS**

- A. After all pumps have been completely installed, conduct in the presence of the Engineer, and operator such tests as are necessary to indicate that pump efficiency and discharge conform requirements specified. Field tests shall be performed on all pumps furnished under this Section. Supply all electric power, labor and water or wastewater and auxiliary equipment required to complete the field tests.
- B. If the pump performance does not meet the specified requirements, corrective measures shall be taken, or pumps shall be removed and replaced with pumps with satisfy the conditions specified. A 24 hour operating period of the pumps will be required before acceptance. During this 24 hour operating period, supply all power necessary.
- C. The pumps and motors shall be designed and constructed to avoid the generation of objectionable noise or vibration. The sound pressure level at full load shall not exceed 90 (A Scale) decibels above 300 cycles, when measured at a point not exceeding 5-ft from the motor. When operating at any point between no-load and full-load, the vibration measured in a horizontal plane at the top of the motor shall not exceed the



limits recommended by the Hydraulic Institute Standards.

- D. Any component parts which are damaged as a result of testing or which fail to meet the requirements specified shall be replaced, reinstalled and retested at the Contractor's expense.

**END OF SECTION**

**DIVISION 13**  
**SPECIAL CONSTRUCTION**

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**SECTION 13200**

**PRECAST CONCRETE BUILDING**

**PART 1 GENERAL**

**1.1 DESCRIPTION OF WORK**

Furnish and install a prefabricated, reinforced concrete building as illustrated in the construction plans.

**1.2 RELATED WORK**

- A. Section 03310 - Concrete
- B. Division 16 - Electrical
- C. Division 17 - Instrumentation

**1.3 SUBMITTALS**

- A. Provide design calculations signed by a Professional Engineer.
- B. Provide Letter of Certification that the building meets Manatee County building code requirements.
- C. Provide working drawings for review.
- D. Provide literature on accessories and finishes.

**1.4 QUALIFICATIONS**

The building shall be manufactured in a plant that is a "National Precast Certified Plant" facility. The manufacturer shall have a minimum of 5 years experience in the manufacture of precast concrete buildings.

**PART 2 PRODUCTS**

**2.1 GENERAL**

The proposed building is a prefabricated, reinforced, modular building. It is designed so that the floor, walls and roof are monolithic and modular at manufacture. Each module shall be welded together with a minimum of 5 steel brackets per joint and is then sealed and

waterproofed. The roof shall have an R value of at least 22. Walls shall have an R value of at least 16.

## 2.2 MINIMUM DESIGN LOADS

- A. Roof live load           60 psf.
- B. Floor live load         100 psf.
- C. Floor dead load         75 psf.
- D. Wall wind load         140 mph.

## 2.3 MATERIALS

- A. Reinforcing Steel - ASTM A615 Grade 60 reinforcing bars and ASTM A185 welded wire fabric.
- B. Concrete - 5,000 psi minimum 28 day compressive strength.
- C. Post-tensioning Strand - 0-5" diameter, 7 wire, tensioning stresses - 5,000 pounds minimum.
- D. Connections - 6" x 8" x 3/8" steel brackets complying with ASTM A36; 1/2" x 2 1/8" Nelson Head Anchors.
- E. Doors and Windows
  - 1) 3'-0" x 7'-0", single exterior door with 24" x 30" window, dead bolt lockset, door retainer hook, exterior pull handle, interior panic bar, door sweep and 2-1/2" drip cap.
  - 2) 6'-0" x 7'-0", double exterior door with 24" x 30" window, dead bolt lockset, door retainer hook, exterior pull handle, interior panic bars, door sweep and 2-1/2" drip cap.

Doors and frames shall be constructed of fiberglass with 316 stainless steel hardware. Window frames shall be constructed of aluminum. Window panes shall be manufactured of Lexan plexi-glass.

- H. Fire extinguisher - Provide two 10 pound fire extinguisher rated for use on Class A, B, and C fires.

## 2.4 FINISHES

- A. Interior
  - 1) Two-inch insulation.

- 2) FRP interior finish.
  - 3) Floor epoxy. Owner shall select color from manufacturer's standard range during shop drawing review process.
- B. Exterior
- 1) 1/2 inch architectural fluted finish with cantilever strip extension at the base and roof line.
  - 2) Factory exterior paint. Owner shall select color and finish from manufacturer's standard range during shop drawing review process.
  - 3) Roof shall be sloped at 1 inch over 6 feet.

## 2.5 SEALANTS

- A. Joints shall be caulked to maintain a permanent seal.
- B. Roof joints shall be sealed and covered with EPDM membrane strips, 12 inches wide, cemented to the concrete and sloped for drainage.

## 2.7 MANUFACTURERS

- A. Concrete Systems, Inc., Londonderry, New Hampshire (888-360-8636).
- B. Or Equal.

## PART 3 EXECUTION

- A. Installation shall be in accordance with manufacturer's recommendations.
- B. Prepare supporting building foundation as indicated in the plans.
- C. Set and level building on foundation.
- D. Install electrical and instrumentation equipment.
- E. Core required openings for incoming lines.
- F. Seal opening per manufacturer's recommendations.
- G. Inspect all seals.

**END OF SECTION**

**DIVISION 14**  
**CONVEYING SYSTEMS**

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**SECTION 14900**

**MONORAIL AND HOIST SYSTEMS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals required and install, test, paint and place in satisfactory operation monorail system and hoist, as shown on the Drawings and as specified herein.
- B. The systems shall be complete with track, trolley, hoist, hangers, clips, stops, fittings, bracing, supporting steel, anchorage, electrification and all appurtenances necessary to complete the installation. The monorail hoist system shall be suitable for exterior installation and capable of hoisting pumping equipment from the Wet Well to the layout area at grade as shown on the Drawings.

**1.02 RELATED WORK**

- A. Section 03310 - Concrete Work
- B. Section 05100 – Structural Steel
- C. Section 05500 - Miscellaneous Metals
- D. Section 09941 – Field Painting
- E. Division 16 - Electrical

**1.03 SUBMITTALS**

- A. Submit to the Engineer, in accordance with Section 01340, certified shop drawings showing erection methods and details, including supports and attachments, signed and sealed by a Professional Engineer registered in the State of Florida.
- B. Six copies of a certificate of compliance with OSHA, Part 1910, Subpart N, Section 1910.179, shall be submitted at the time that shop drawings are submitted.
- C. Literature on drawings describing the equipment and showing all-important details of construction and dimensions including, but not limited to:
  - a. Make, model, weight, and horsepower of each equipment assembly.
  - b. Complete catalog information, descriptive literature, materials of construction, and

specifications on trolley, hoist, wheels, gears and bearing, drive systems, motors and assemblies, hook, brakes, starting system, conductors (bus bar, festoon, cable reel), controls, and accessories.

- c. Power and control wiring diagrams, including terminals and numbers.
  - d. Motor nameplate data in accordance with NEMA MG 1, and include any motor modifications.
  - e. Factory finish system.
- D. Operating and Maintenance Data
- 1. Operating and maintenance instructions shall be furnished to the Engineer as provided in Section 01730.
  - 2. A factory representative who has complete knowledge of proper operation and maintenance shall be provided for 1 day to instruct representatives of the Owner and Engineer on proper operation and maintenance. This work may be done in conjunction with the inspection of the installation and test run as provided under Paragraph 3.02 below.

#### **1.04 REFERENCE STANDARDS**

- A. American Welding Society (AWS)
- B. Occupational Safety and Health Administration (OSHA)
- C. Monorail Manufacturers Association (MMA)
- D. American Institute of Steel Construction (AISC)
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### **1.05 QUALITY ASSURANCE**

- A. To insure total unit responsibility, the monorail hoist system shall be furnished by one supplier/installer who will install the system, including furnishing and installing the support members. The supplier/installer shall be fully experienced, reputable and qualified in the manufacturing and installation of the equipment for a minimum period of ten (10) years.
- B. All of the monorail track, (not including Standard I beams) and carrier equipment on monorail track shall be products of a single, experienced, reputable and qualified



manufacturer who is a member of the MMA. Carrier equipment for hoists on I beam track shall be provided by the hoist manufacturer.

- C. All of the hoisting equipment shall be the product of a single, experienced, reputable and qualified manufacturer who is a member of the Hoist Manufacturers Institute.
- D. It is the responsibility of the Contractor to guarantee that the monorail and hoisting equipment shall be completely operational in all locations.
- E. The current issue of Underhung Cranes and Monorail Systems by the MMA and the Hoist Manufacturers Institute shall be included as a part of this Section unless otherwise specified.
- F. All structural steel members of the handling system, including standard I-beam track and appurtenances, shall be designed in accordance with AISC current edition and any welded construction shall be in accordance with the standards of AWS and comply with Section 05500.
- G. Castings, forgings, stampings and other structural elements shall have a safety factor of 5.
- H. All equipment shall meet or exceed the requirements of OSHA.

## **1.06 MAINTENANCE**

- A. Tools and Spare Parts
  - 1. Special tools and spare parts, if required for normal operation and maintenance, shall be furnished with the equipment as specified in Section 01730.

## **1.07 WARRANTY AND GUARANTEE**

- A. The Manufacturer shall guarantee the monorail system, when installed and operated as recommended by the Manufacturer with a documented maintenance program, trouble-free operation for a period of three (3) years. If the Owner or Engineer is not completely satisfied with the performance of the product, the Manufacturer shall remedy the problem at no cost or refund the materials and installation cost upon the return of the equipment.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. The monorail hoist system shall be supplied/installed by JHerbert Corporation of Kissimmee, Florida (407-846-0588), or equal.

- B. Monorail Hoist System. This system will be used for removal, handling, and replacement of equipment in a submersible wastewater lift station. All components shall be suitable for outside installation.
1. Service Classification - Class C (Moderate Service).
  2. Hoist - Standard Headroom, Electric, Chain Type, lug mounted.
    - a. Lift Capacity - 2 tons
    - b. Lift - 30-ft
    - c. Lift Speed - 8 fpm (min.)
  3. Carrier (Trolley) - Dual Wheel Motor Drive
    - a. Travel Speed - Single 35 fpm
    - b. Supplier - Track Manufacturer
  4. Track - Monorail Track
    - a. Total Length - Approximately 39-ft
    - b. Clear Span - 10-ft
    - c. Track Support - As detailed.
  5. Electrification and Control
    - a. Power – 480 volt, 3 phase
    - b. Electrification Type – Cable Reel
    - c. Control Station - Outrigger pushbutton pendant rated NEMA 4X.
- C. This Section calls attention to certain features, but does not purport to cover all details of construction of the units.
- D. This Section selects options and modifies the requirements referred to in Paragraph 2.01B above and supplement or modifies them based on specific system requirements.
- E. All runway and monorail track, suspension fittings, carriers and trolleys, electrification, and related accessories shall be manufactured by Coffing Hoists, Wadesboro, NC; Cleveland Tramrail, Wickliffe, OH; American Monorail, Inc., Cleveland, OH; Whiting Corporation, Harvey, IL or equal.
- F. All hoisting equipment shall be manufactured by Coffing Hoists, Wadesboro, NC; Eaton Corporation (Yale) Hoisting Equipment Division, Forrest City, AR; Harnischfeger (P&H), Milwaukee, WI or equal.

- G. Structural steel components shall be in accordance with Section 05100, Structural Steel.

## **2.02 RUNWAY AND MONORAIL TRACK**

- A. Monorail track shall be constructed of a high carbon manganese or vanadium alloy steel "T" bottom section with a Brinell hardness of 225 minimum, a carbon steel web plate and a top flange plate. The bottom "T" shall be 3-1/4-in wide. The components shall be joined by high-penetration machine welding.
- B. Track shall be sized for maximum loads anticipated on spans with deflection not to exceed 1/600 of span.
- C. All track hardware including splices, curves, end stops or other items necessary to furnish a complete system shall be provided as required for the systems.

## **2.03 SUSPENSION FITTINGS**

- A. All necessary clamps, hanger rods and other fittings from which a track or runway is supported shall be provided as part of the system. Hangers shall be spaced as shown on the Drawings to support the load resulting from the maximum loading condition.
- B. Coordinate with the monorail equipment supplier to determine location, type and sizes of connections required to fasten the suspension fittings to the supporting structure. Suspension systems shall be as shown on the Drawings.

## **2.04 CARRIERS OR TROLLEYS**

- A. Wheels shall be drop forged steel, induction hardened to a minimum of 425 Brinell. Bearings shall be double row, combination radial and thrust, anti-friction precision type. They shall be prelubricated and sealed and have a minimum B-10 bearing life of 3,000 hours.
- B. Motor propelled carriers shall have a travel speed as specified in Paragraph 2.01 above.
- C. Drive motors for carriers shall be totally enclosed non-ventilated duty rated for the application. Motor power circuits shall be supplied with cushioning ballast resistors to provide smooth and uniform acceleration.

## **2.05 HOISTS**

- A. Electric chain hoists shall be supplied with trolley types specified in Paragraph 2.01 above. Each hoist shall be equipped with a mechanical load brake; an electrically activated motor brake; oil bath lubricated gearing; anti-friction bearings throughout; upper and lower hook travel limiting devices and load limiting device to prevent overload.

- B. Electric hoist motors shall be totally enclosed non-ventilated duty rated for the application.
- C. All hoists shall have full blocks with safety latch swivel hooks.
- D. Provide chain baskets for all chain hoists.

## **2.06 ELECTRIFICATION**

- A. Cable reel electrification shall be provided using cable sized for the hoist and designed for use on a cable reel (to prevent twisting under tension). The reel shall be located to allow smooth operation of the hoist and be supplied with all brackets, swivels and connectors to provide complete installation. The cable reel system enclosure shall be suitable for outside installation.

## **2.07 ELECTRIC CONTROLS**

- A. Control shall be through a pushbutton pendant suspended from the hoist at a convenient distance above the operating level. The pendant shall have "Raise" and "Lower" buttons for the hoist and "Forward" and "Reverse" for the hoist trolley. In addition the pendant shall contain an on-off switch which will disconnect all power to the equipment. A wobble switch shall be provided at the bottom of the pendant station which when moved laterally will interrupt main line power to the hoist and trolley. The pendant shall be provided with a reset button to re-energize the main line power circuit.
- B. Control power at the pendant shall be 115 Volts.

## **2.08 PAINTING**

- A. Hoist and trolley shall have factory applied epoxy finish in safety yellow.
- B. Ferrous metals (steel beams, bridges, tracks, supports, etc.) shall be surface prepared to SSPC-6 commercial blast, and shall be shop painted with one coat of primer (Polyamide Epoxy (56%), Tnemec Series 66 -1211 (Red), Hi-Build Epoxoline or equal, at 3.0-5.0 mils DFT) and one coat Polyamide Epoxy (56%), Tnemec Series 66 or equal, at a dry film thickness of 4-6 mils DFT. Paint shall be safety yellow.
- C. After installation, the entire unit shall be thoroughly inspected. Any damaged paint areas shall be touched-up with paint compatible with the shop coats.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Installation shall be in strict accordance with the respective instructions of the manufacturer and in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

### **3.02 INSPECTION AND TESTING**

- A. Notify the manufacturer to furnish the services of a factory representative for 1 day who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test run of the equipment. These services may be combined with those provided under Paragraph 1.03D above.
- B. Working under the direction of the manufacturer, and in the presence of the Engineer, perform field tests as follows:
  - 1. Full load operating tests on all monorail systems.
  - 2. Furnish the labor and weights for testing capacity of hoists.
  - 3. In the event the equipment fails to meet the above test, the necessary changes shall be made and the equipment retested. If the equipment remains unable to meet the test requirements to the satisfaction of the Engineer, it shall be removed and replaced with satisfactory equipment at the expense of the Contractor.
  - 4. All defects recorded during the above field tests and all defects and failures occurring within the first year of operation shall be corrected.

**END OF SECTION**

**DIVISION 15**  
**MECHANICAL**

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**SECTION 15066**

**STAINLESS STEEL PIPE AND FITTINGS**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals required and install, test, complete and ready for operation all stainless steel pipe as shown on the Drawings and as specified herein.
- B. Where the word "pipe" is used it shall refer to pipe, fittings, hangers, supports and appurtenances unless otherwise noted.
- C. The work includes, but is not necessarily limited to:
  - 1. Furnishing and installing interior and below grade flanged stainless steel pipe, fittings and specials.
  - 2. Furnishing stainless steel pipe sleeves and stainless steel pipe wall castings for interior and exterior wall and foundation wall penetrations.

**1.02 RELATED WORK**

- A. Section 03010 - Concrete
- B. Section 02640- Valves and Appurtenances
- C. Section 09941 - Field Painting
- D. Section 15110 - Pipe Hangers and Supports

**1.03 SUBMITTALS**

- A. Submit to the Engineer, in accordance with Section 01340, the following:
  - 1. Submit the name of the pipe, fitting and appurtenances manufacturers and a list of the material to be furnished by each manufacturer. Also include information on local representative for each manufacturer, if product is sold through a distributor.
  - 2. Shop drawings including piping layouts and schedules, including dimensioning, fittings, expansion joints, locations of valves and appurtenances, joint details, wall penetration details, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished. Shop drawings shall include all data and

information required for the complete piping systems. All dimensions shall be based on the actual equipment to be furnished. Types and locations of pipe hangers and/or supports shall be shown on the piping layouts for each pipe submittal. Contractor shall be responsible for accurate dimensioning of piping systems.

3. Proposed cleaning method, including precleaning, descaling, chemicals to be used, or mechanical descaling method and final cleaning/passivation
4. Certifications that welders are qualified, in accordance with ANSI B31.1, Paragraph 127.5 for shop and project site welding of pipe work.

#### **1.04 REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM)
  1. ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
  2. ASTM A530 - Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
  3. ASTM A778 - Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
- B. American National Standards Institute (ANSI)
  1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250.
  2. ANSI B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
  3. ANSI B36.19 - Stainless Steel Pipe
- C. American Water Works Association (AWWA)
  1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- D. American Society of Mechanical Engineers (ASME)
  1. ASME B31.1 - Power Piping.
- E. American Welding Society (AWS)
- F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.



### **1.05 QUALITY ASSURANCE**

- A. Stainless steel pipe and fittings shall be furnished by a single manufacturer who is fully experienced, reputable, qualified and regularly engaged for the last 5 years in the manufacture of the materials 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 this Section.

### **1.06 SYSTEM DESCRIPTION**

- A. Piping shall be installed in those locations as shown on the Drawings.
- B. The equipment and materials specified herein are intended to be standard types of stainless steel pipe and fittings for use in transporting wastewater.
- C. Stainless steel piping for the system listed below shall be designed for the following conditions:
  - 1. System: Pump discharge piping to the valve vault.

### **1.07 DELIVERY, STORAGE AND HANDLING**

- A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe and fittings. Pipe and fittings shall not be dropped. Pipe and fittings shall be examined before installation and no piece shall be installed which is found to be defective.
- B. In handling the pipe, wide cushioned slings or other devices and methods acceptable to the Engineer shall be used. No uncushioned ropes, chairs, wedges or levers shall be used in handling the pipe, fittings and couplings.
- C. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe by the Contractor, at the Contractor's own expense. All pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until they are put into service.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. All stainless steel pipe and fittings shall be fabricated from stainless steel sheet and conform to ASTM A312, Type 316L. Carbon content of Type 316L material shall be 0.03 percent maximum. Finish shall be No. 1 or No. 2D.

B. Pipe shall be die-formed or rolled true to dimension and round. Tolerances for length, inside and outside diameter and straightness shall conform to ASTM A530. The two edges of sheet shall be brought to line so as not to leave a shoulder on the inside of the pipe. Ends of pipe and fittings shall be perpendicular to the longitudinal axis. Longitudinal seams on pipe and fittings shall be welded by either the tungsten gas or the metallic-gas method. The interior welds shall be smooth, even and shall not have an internal bead higher than 1/16-in. All pieces shall be marked with gauge and type of stainless steel and with the initials of the inspector marked on the inside of each piece, at each end.

C. Pipe and fittings shall be supplied with the following wall thicknesses:

<u>DIAMETER (INCHES)</u>	1. WALL THICKNESS SCHEDULE PER <u>ANSI B36.19</u>	2. <u>INCHES</u>
12-inch	40S	0.375

D. Fittings shall be smooth curve type manufactured to ASTM A403. Fittings shall conform to ANSI B16.9.

E. Flanges for pipe larger than 4-in shall have stub ends or rolled angle rings of the type of stainless steel as the pipeline welded to the pipe end, with suitable gaskets between the mating surfaces and joined through the use of 125 lb rated back-up flanges, drilled to ANSI B16.1, and made of Type 316 stainless steel. Where the pipe stub is to pass through a sleeve during installation, a split-type back up flange shall be used. Bolts, washers, nuts and other hardware for flange bolting shall be Type 316 stainless steel.

F. Gaskets for flanged connections shall be a minimum of 1/16-in thick and shall be rubber.

G. Shop fabricated multiple output headers may be used in lieu of individual flanged fittings.

H. Wall pipes shall have integral shop welded wall stops.

I. All stainless steel pipe and fittings shall be pickled at the point of manufacture, scrubbed and washed until all discoloration is removed in accordance with ASTM A380. Pipe and fittings shall be sandblasted and cleaned with solvent or other means acceptable to the Engineer.

J. Pipe ends shall be prepared for couplings or other type ends where required by transport and handling limitations, where required by the support layout requirements and where noted on the Drawings. All normal pipe joints at valves, bends, etc, shall be flanged, drilling per ANSI B16.1, Class 125.

- K. Shop welding of fabrications shall be done according to the procedures and by welders certified per ASME Section IX. Welds shall be by an inert gas shielding process using only extra low carbon filler metals. Welds shall have a bead height of no more than 1/16-in. Butt welds shall have 100 percent penetration to the interior or backside of the weld joint. Cross-sectional thickness of welds shall be equal or greater than that of the parent metal.
- L. Where shown on the Drawings or where approved by the Engineer, plain end pipe shall be joined by all stainless steel flexible couplings. Sleeve type couplings shall be of the Type 316L stainless steel and shall be Style 38 as manufactured by Dresser Manufacturing Division of Dresser Industries; coupling 411 as manufactured by Smith Blair, Inc. or equivalent couplings manufactured by Depend-O-Lok Co.
- M. Where shown on the Drawings or where approved by the Engineer, flanged coupling adaptors shall be used to connect plain end pipe to equipment, fittings and valves. Flanged coupling adaptors shall be of the Type 316L stainless steel and shall comply with AWWA C207. Flanged coupling adapters shall be manufactured by Dresser Manufacturing Division of Dresser Industries; Smith Blair, Inc. or equal.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. All pipe and fittings shall be installed true to grade and alignment and pipe anchorage and/or restraint shall be provided where required. Manufacturer's instructions shall be strictly followed.
- B. All pipe and fittings shall be protected from dirt, dust, oil, grease and other foreign matter during installation to prevent damage to pipe and to assure no foreign matter is left in the piping.
- C. To assemble the joints in the field, thoroughly clean all joint surfaces and gaskets, if any, with soapy water before assembly. Bolts shall be tightened alternately, evenly to the manufacturer's specified torques. Under no condition shall extension wrenches or pipe-over-handle ratchet wrenches be used to secure greater leverage. All electrical bonding or insulation shall be installed as joints are made up.
- D. Fittings, in addition to those shown on the Drawings, shall be provided if required. Due consideration shall be given to thermal expansion/contraction over a temperature range of 200 degrees F.
- E. Sleeves of the proper size shall be installed for all pipes passing through floors or walls as shown on the Drawings. Sleeves shall be as specified in Section 01172.

- F. When cutting of pipe is required, the cutting shall be done by machine neatly, without damage to the pipe. Cut ends shall be smooth and at right angles to the axis of the pipe.
- G. After installation, stainless steel pipe lines shall be washed clean with steam or hot water to remove any foreign material picked up during transport.

### **3.02 JOINING FLANGED JOINTS**

- A. Flanged joints shall be made with gasket, bolts and nut bolts stud with a nut on each end, or studs with nuts where the pipe is tapped. The number and size of bolts shall conform to the same standard requirements as the flange.

### **3.03 FIELD WELDING**

- A. Welding in the field shall be done only if approved by the Engineer. Field welds shall be made by welders certified under ASME Section IX and be equal in all respects to shop welds. After field welding has been done, all joints shall be thoroughly cleaned and buffed using deburring and finishing wheels.

### **3.04 FIELD TESTING**

- A. Field Testing of the pipe is specified in Section 02617, Installation and Testing of Pressure Pipe.

**END OF SECTION**

## SECTION 15110

### PIPE HANGERS AND SUPPORTS

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. 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 and duct.

##### 1.02 RELATED WORK

- A. Division 2 – Site Work
- B. Division 3 – Concrete
- C. Division 5 - Metals
- D. Division 9 - Finishes
- D. Section 15120 – Process Piping and Appurtenances

##### 1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01340 – Shop Drawings, Project Data and Samples:
  - 1. Shop and erection drawings stamped and signed by a Professional Engineer.
  - 2. Shop drawing data for necessary items.
  - 3. Prior to fabrication, submit a copy of the Contractor's piping drawing indicating location of pipe supports, identified by hanger mark numbers.
  - 4. Pipe stress analysis including all forces transmitted to pipe supports and anchors performed prior to pipe support design.
  - 5. Welding Procedure - Submit description as required to illustrate each welding procedure to be performed in the specified work.
  - 6. Welding Equipment - Submit descriptive data for welding equipment, including type, voltage and amperage.
  - 7. Qualification for Welders - Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If recertification of welders is required, retesting is the Contractor's responsibility at no additional cost to the Owner.
  - 8. Pipe support manufacturer's qualifications as specified in Paragraph 1.05E.

- a. List of at least 5 successful pipe support projects and current addresses and telephone numbers of persons in charge of representing the Owner or the Owner of those construction projects during the time of pipe support design and installation.
- b. Qualifications of manufacturer's Registered Professional Engineer who stamps and seals shop drawings and designs.

#### **1.04 REFERENCE STANDARDS**

- A. American Institute of Steel Construction (AISC) Manual for Steel Construction
- B. American Society for Testing and Materials (ASTM) Publications
  1. A36 - Specification for Structural Steel
  - A500 - GR B Tube Steel
  2. E165 - Practice for Liquid Penetrant Inspection Method
  3. E709 - Practice for Magnetic Particle Examination
  4. A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
  - A312 - TP304L
  5. A572 - Specification for Steel Plate
- C. American National Standards Institute (ANSI)
  1. B31.1 - Power Piping Code
- D. American Welding Society (AWS) Code
  1. A2.0 - Structural Welding Code D1-1-7
- E. Manufacturer's Standardization Society (MSS)
  1. MSS-SP-58 - Pipe Hangers and Supports - Materials and Design
  2. MSS-SP-69 - Pipe Hangers and Supports - Selection and Application
  3. MSS-SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- F. National Association of Expansion Joint Manufacturers.

#### **1.05 QUALITY ASSURANCE**

- A. Pipe Supports - Conform to the requirements of Manufacturer's Standardization Society MSS-SP-58, MSS-SP-69, MSS-SP-89, and Paragraphs 120 and 121 of ANSI B31.1 and as specified and indicated.

- B. Design Loads - Support pipe system to accommodate for all dynamic, static, thermal and imposed loads, such as wind that pipe systems may be subjected to.
- C. Structural Concrete Designs - Conform to the requirements of Section 03300 - Cast-in-Place Concrete. Concrete strength - 4,000 psi unless noted otherwise.
- D. Conform to the requirements of AISC Manual for Steel Construction for miscellaneous steel and supplementary steel. Tube steels are A500 Grade B, wide flange A-36, Plates A-572, or equal. Stainless steel structural members to conform to ASTM requirements for T-304 or T-316 as indicated.
- E. Pipe Support Manufacturer Qualifications
  - 1. Fabricator must submit a written quality assurance program.
  - 2. Have a minimum of 5 years experience in the manufacture of pipe supports.
  - 3. Have completed at least 5 successful pipe support projects of equal size, complexity, and systems as project specified and indicated.
  - 4. Retains the services of a Professional Engineer Registered in Florida with a minimum of 10 years experience in the design of pipe supports.

## **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Shipping
  - 1. Ship material complete except where partial disassembly is required by transportation regulations or for protection of components.

## **1.07 INSTALLATION, OPERATION AND MAINTENANCE MANUALS**

- A. In addition to the normal Installation, Operation and Maintenance manuals required by contract, a spare manual shall be shipped with the unit in order to allow for proper operation of equipment prior to release of all final Installation, Operation and Maintenance Manuals to the end user.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. All pipe and duct shall be supported as required to prevent significant stresses in the pipe or duct 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 seismic events and equipment, pipe, and personnel contact. Structural steel members required to brace piping from excessive dislocation shall comply with the requirements of Division 5

and shall be furnished and installed under this section. All pipe supports shall be approved prior to installation.

- B. Space hangers and supports in compliance with ANSI B31.1 except that the maximum unsupported span shall be as shown on the standard details unless otherwise specified.
- C. Unless otherwise specified, pipe hangers and supports shall be as manufactured by Grinnell Company, Inc., Elcen Company, Unistrut Corporation, Carpenter & Paterson, Inc., or equal. 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 SUPPORTS**

- A. General
  - 1. All new components of the pipe support systems, including anchors, shall be of Type 316 stainless steel. Pipe clamp straps shall be aluminum.
- B. Wall and Beam Supported Pipes
  - 1. Pipe shall be supported from walls using a channel and clamp system, such as the Grinnell Power-Strut or Unistrut Corporation systems.
  - 2. Channels shall be Power-Strut PS 400 stainless steel channels, fastened to walls with stainless steel expansion anchors.
  - 3. Pipe clamps shall have aluminum straps and stainless steel fasteners, Power-Strut PS 1100 or equal.
- C. Floor and Slab Supported Pipes
  - 1. Pipes shall be supported from floors and slabs using the channels and clamps described above. Channels shall be mounted to floors with stainless steel post boxes, Power-Strut PS 3033 or equal.

## **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 specified. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Owner.



- 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, seismic events, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Owner.
- 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 on pump housings. Pump housings shall not be utilized to support connecting pipes.
- D. Pipe supports shall be provided as follows:
  - 1. Support steel and ductile iron at a maximum support spacing as shown on the Drawings 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 4 feet.
  - 3. Support vertical pipes at each floor or at intervals of not more than 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 on 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 location. Responsibility for the proper location of pipe supports is included under this section.

### **3.02 PAINTING**

- A. Surface preparation and shop priming is a part of the work of this section and shall be as specified in Section 09941, Field Painting.
- B. Finish coating is included in Section 09941, Field Painting.

**END OF SECTION**

**DIVISION 16**  
**ELECTRICAL**

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## SECTION 16010

### BASIC ELECTRICAL REQUIREMENTS

#### PART 1 GENERAL

##### 1.01 SUMMARY

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

##### 1.02 DEFINITIONS

- A. "Contract Documents" shall be understood to include the Contract Specifications, Contract Drawings, official addenda, official revision bulletins, and all other official documents.
- B. "Electrical equipment and materials" shall be understood to include all electrical related equipment, apparatus, components, devices, assemblies, materials, accessories, and appurtenances.
- C. "Owner" shall be understood to include the Owner's Designated Representative.
- D. "Provide" shall be understood as "furnish and install."

##### 1.03 BASIC REQUIREMENTS

- A. Contractor's Charge: It shall be this Contractor's responsibility to complete the Work of this project as conveyed in these Contract Specifications and on the Contract Drawings.
- B. Site Inspection: Prior to Bid, the Contractor shall thoroughly inspect the Project Site and shall become familiar with project areas and existing site conditions.
- C. Hazardous Materials
- D. Conditions: Advise the Owner and Engineer/Architect in writing of any suspected hazardous materials and hazardous conditions discovered during the course of the Work. Make this notification as soon as the discovery is made.
- E. General: Installations shall conform to the requirements of NFPA 70, NFPA 101, and IEEE C2, unless more stringent requirements are indicated herein or elsewhere on the Contract Drawings.
- F. Workmanship: All work must be performed in a neat and workmanlike manner by a licensed journeyman electrician or a certified apprentice working under the direct supervision of a licensed journeyman electrician, and shall present a neat and professional appearance when complete.

- G. Electrical Equipment and Materials: Listed and labeled as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Laboratory meeting the requirements of OSHA 29 CFR 1910.
- H. Electrical Equipment and Materials described in these specifications and on the Contract Drawings establish the minimum standards for quality and style, shall be the basis of the bid, and shall be new unless otherwise indicated as existing. Manufacturer names are indicated as basis of design, or suggested alternate manufactures. Alternates shall be considered upon approval of the engineer.
- I. Electrical Equipment and Materials shall be installed in accordance with the manufacturer's recommendations using the best methods known to the trade.
- J. Onsite Storage: Onsite storage of electrical equipment and materials, and tools will be at the Owner's discretion and the Contractor's risk. The Contractor shall follow the pathways as directed by the Owner for the movement of electrical equipment and materials, and tools in and out of the building, and to and from the project areas. Such pathways will be established by the Owner, and are subject to change at the Owner's discretion.
- K. Delivery, Storage, and Handling: Equipment and materials shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced at the Contractor's expense. Stored items shall be protected from theft.
- L. Maintenance of Work Areas: The Contractor shall maintain all work areas in a neat and orderly fashion. The Contractor shall employ means as necessary including, but not necessarily limited to, dust curtains, to prevent the migration of dust, dirt, and debris from the immediate project areas to other areas accessible to the public and/or other building occupants. The Contractor shall clean all work areas of dust, dirt, and debris at the end of each workday and more frequently if directed to do so by the Owner.
- M. Protection: The Contractor shall make every effort to ensure a safe work environment for his employees, contractors, and agents, and for the public. The Contractor shall follow the applicable requirements and recommendations of OSHA. All exposed energized equipment, components, and wiring shall be shielded from accidental contact by employees, workers and building visitors. In no case shall exposed energized equipment, components, or wiring be left unprotected or unguarded. The Contractor shall provide all warning apparatus and materials required to cordon off the Project Site from those not directly associated with the Project including, but not necessarily limited to, warning tape and barriers, cones, signs, and dust curtains. The placement and erection of warning apparatus and materials shall be coordinated with, and to the satisfaction of the Owner and/or Engineer/Architect.
- N. Installations: The Contract Drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the Work and verify all dimensions in the field so that

equipment and materials shall be properly located and readily accessible. The Contractor shall sequence, coordinate, and integrate the various elements of electrical equipment and materials and comply with the following:

1. Verify all dimensions by field measurement.
  2. Coordinate the installation of electrical equipment and materials with other building systems, features, and components.
  3. Sequence, coordinate, and integrate the installation of electrical equipment and materials for efficient flow of the Work.
  4. Install electrical equipment and materials to conform with approved submittal data to the greatest extent possible. Conform to the arrangements indicated on these drawings recognizing that portions of the work are shown only in diagrammatic form.
  5. Any confusing, conflicting, or unclear information on these drawings shall be referred to the Engineer/Architect prior to the bid for his resolution. By failing to refer confusing, conflicting, or unclear information in the Contract Documents to the Engineer/Architect for his resolution prior to the 75%, the Contractor thereby acknowledges the Contract Documents as error free.
  6. In general, install electrical equipment and materials level and plumb, parallel and perpendicular to building lines and features.
  7. Install electrical equipment and materials to facilitate servicing and maintenance, and repair or replacement of component parts. To the greatest extent possible, connect electrical equipment for ease of disconnecting with a minimum of interference with other installations.
- O. Power Outages: The Contractor shall schedule power outages as required to complete the Work of this Project. The number and duration of power outages shall be kept to an absolute minimum. Power outages must be coordinated and scheduled with the Owner with a minimum of fourteen-(14) calendar days advance notice.
- P. Temporary Power and Lighting:
- Q. Permits / inspections: Obtain (arrange, apply, pay for, and maintain) and post all required construction permits. Obtain (arrange, apply, and pay for) inspection of all electrical work performed under this Contract.
- R. Quality Control: Upon completion of the Work, but prior to the punchlist inspection, the Contractor shall complete the following:
1. General: Verify that all electrical equipment is installed, operational, and fully functional in accordance with the manufacturer's requirements and tolerances.
  2. Connections and Terminals: Verify all electrical connectors and terminals have been tightened in accordance with the manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3. Receptacles: Test each receptacle for proper polarity and ground connection. Test each ground fault circuit interrupter (GFCI) receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions. Replace damaged or defective components and retest.
  4. List of Adjustable Circuit Breaker Settings: Submit a word processed, computer generated, itemized listing of all adjustable circuit breakers installed as part of the work of this Project, with their final over-current relay and ground fault relay settings.
  5. Infrared Scanning: Perform an infrared scan of switchgear two weeks after Substantial Completion and before Final Acceptance. Make bus joints and connections accessible to a portable scanner and perform scanning during a period of normal working load as advised by the Owner. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device. Prepare a certified report that identifies switchgear checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- S. Facilitate Punchlist Inspection: The Contractor shall make one journeyman electrician available to accompany the Engineer/Architect during the punchlist inspection. The journeyman electrician shall assist the Engineer/Architect including, but not necessarily limited to, the removing of equipment covers to facilitate inspection of equipment interiors. The punchlist inspection shall be scheduled by the Engineer/Architect with a minimum of 7 calendar days advance notice following the Contractor's notification of his successful checkout and testing of the completed installations. During the punchlist inspection, the Engineer/Architect will survey the completed installations for compliance with Contract Requirements. Subsequent to the punchlist inspection, the Engineer/Architect will compile a list of installation deficiencies. The Owner's notification to the Contractor of Final Acceptance will not be issued until all installation deficiencies have been corrected to the satisfaction of the Owner and/or Engineer/Architect.
- T. Record Drawings: The Contractor shall maintain at the site a clean undamaged set of blue or black-line white prints of the Contract Drawings. This record set drawings shall be marked to show the actual installation, and where the actual installation varies substantially from the Work as originally shown. Mark whichever drawings are most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Mark record drawings with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

**END OF SECTION**

## SECTION 16020

### INSTALLATION OF UNDERGROUND ELECTRICAL DUCT BANKS, CONDUIT, MANHOLES AND HANDHOLES

#### PART 1 GENERAL

##### 1.01 DESCRIPTION OF WORK

- A. This item shall consist of underground electrical ducts or conduits installed in accordance with this specification at the locations and in accordance with the dimensions, designs, and details shown in the Contract Drawings for the new feeder system work. It shall also include all concrete encasement, mandrelling, installation of pull wires and duct markers, capping, core drilling, and the testing of the installation as a completed raceway system ready for the installation of cables, to the satisfaction of the Engineer.

This item shall also include furnishing and installing manholes and handholes at locations shown on the Drawings, including cable pulling rings, cable racks, bell ends, ground rods, grounding non-current carrying metal parts, core drilling existing manholes, handholes and light bases and shall also include adjusting of existing duct markers.

All trenching, backfilling, removal and restoration of all paved areas shall be covered under another section of this Specification.

##### 1.02 RELATED WORK

- A. Carefully examine all of the Contract Documents for requirements that affect the work of this section.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards except where more stringent requirements are shown or specified:
1. National Board of Fire Underwriter's National Electrical Code, latest edition.
  2. Underwriter's Laboratories, Inc., Standards for Cabinets and Boxes, Service Equipment, and Rubber-Covered Wires and Cables.
  3. National Electrical Manufacturer's Association Standards.
  4. All applicable state and local codes or ordinances.
  5. Insulated Power Cable Engineer's Association Standards.
  6. Occupational Safety and Health Regulations.
  7. Institute of Electronic and Electrical Engineers' Standards.

- B. Federal material requirements shall comply with the following:

Number	Title
A 48-76	Gray Iron Castings
A 120-79	Pipe, Steel, Black or Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for ordinary uses
A 123-78	Zinc (hot-galvanized) on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
A 615-79	Deformed and Plain Billet-Steel Bars for Concrete Reinforcements

#### **1.04 SHOP DRAWINGS**

- A. Shop drawings and design calculations showing precast concrete electrical handholes and/or manholes, if used, reinforcement size and location, inserts, grout holes, bolt holes, slab, wall and roof openings shall be submitted to the Engineer for approval.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the acceptable specification when so requested by the Engineer.

#### **2.02 STEEL CONDUIT**

- A. Rigid steel conduit and fittings shall be galvanized and conform to the requirements of Underwriters Laboratories Standard 6514 and 1242. Rigid steel conduit installed underground without concrete encasement shall be PVC coated. All PVC coated conduits and fittings installed underground shall be coated with 40-mil polyvinyl chloride, bonded to the conduit with an epoxy primer. PVC coated conduits shall conform to NEMA RN1-1980 (Type 40).

#### **2.03 CONCRETE**

- A. Concrete shall conform to the requirements for Portland cement concrete, using 1-inch maximum size coarse aggregate, of Section 03300 "Cast in Place Concrete" of this Specification.

#### **2.04 CAST-IN-PLACE ELECTRICAL MANHOLES AND HANDHOLES**

- A. Manholes and handholes shall be constructed in accordance with the details shown on the drawings. Precast units may be substituted for cast-in-place. Shop drawings



must be provided and establish the ability of the precast units to support required loadings. Frames and covers shall be of the manufacturer and type as indicated on the Drawings. Covers shall be imprinted with the work "ELECTRIC" or shall be imprinted as shown or called for on the Drawings.

Concrete shall be in accordance with specification "Portland Cement Concrete", of these Specifications.

Frame and cover shall be of the manufacturer and type as indicated on the Drawings. Covers shall be imprinted as shown or called for on the Drawings.

Ground rods for the electric manhole shall be as shown on the Drawings. Non-current carrying metal parts in the manholes, including metallic sheathes of cables shall be connected to the ground rods with bare copper conductors.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. The Contractor shall install underground ducts, manholes and handholes at the approximate locations indicated in the Contract Drawings. The Engineer may indicate specific locations as the work progresses. Ducts shall be of the size, material, and type indicated in the Contract Drawings or Specifications. Where no size is indicated in the Contract Drawings or Specifications, the ducts shall be not less than 4 inches inside diameter. All duct lines shall be laid so as to grade toward handholes, manholes, vaults, and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to run the grade all one way, the duct lines shall be graded from the center in both directions toward manholes, handholes, or duct ends. Pockets or traps where moisture may accumulate shall be avoided.
- B. The Contractor shall utilize large radius sweeps for all duct and conduit direction changes and for all elbows entering concrete slabs. The minimum inside radius shall be 30" for all ducts and conduits larger than 1-1/2" nominal.
- C. The Contractor shall mandrel each duct. An iron-shod mandrel, not more than 1/4-inch smaller than the bore of the duct shall be pushed through each duct by means of jointed conduit rods. The mandrel shall have a leather or rubber gasket slightly larger than the duct hole.
- D. Any non-metallic ducts which terminate in concrete walls of new manholes or handholes shall terminate in bell ends, flush with the inside wall. Non-metallic ducts which terminate in concrete walls of existing manholes or handholes shall be brought through the wall in core drilled holes, trimmed flush with the inside wall, grouted into place.
- E. All new ducts and conduits installed and all empty/spare extended ducts shall be provided with a 1/4 inch polypropylene monofilament rope for pulling the permanent

wiring. Sufficient length shall be left in manholes or handholes to tie the drag wire back to prevent it from slipping back into the duct.

- F. All ducts shall be securely fastened in place during construction and progress of the work and shall be plugged to prevent seepage of grout, water, or dirt. Any duct section having a defective joint shall not be installed.
- G. All nonmetallic ducts installed under paved areas shall be encased in a concrete envelope.
- H. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

### **3.02 DUCTS ENCASED IN CONCRETE**

- A. Unless otherwise shown in the plans, concrete-encased ducts shall be installed so that the top of the concrete envelope is not less than 24 inches below the finished subgrade where installed under paved areas, and not less than 18 inches below finished grade in unpaved areas. Ducts, conduits and duct banks, which terminate in infield areas, but not in manholes or handholes shall extend beyond the pavement edge at least 5 feet and shall have keyed ends to provide for future extension. Trenches for concrete-encased ducts shall be opened the complete length between bases, manholes, handholes, etc., before concrete is laid so that if any obstructions are encountered, proper provisions can be made to avoid them. All ducts for concrete encasements shall be supported on plastic spacers designed for the purpose. Spacer bases shall be installed on wooden planks. The wooden planks shall be installed on a base of 3" of compacted sand in the bottom of the trench. Where two or more ducts are encased in concrete, the contractor shall space them not less than 1½ inches apart (measured from outside wall to outside wall) using spacers applicable to the type of duct. As the duct laying progresses, concrete not less than three inches thick shall be placed around the sides and top of the duct bank. Couplings shall be installed flush with the edge of the concrete encasement where it is required to terminate the duct bank in earth.
- B. When pouring ducts for consecutive days, between each day's pour shall be a reinforced joint as detailed on the Drawings. When pouring ducts for future extensions, there shall be a keyed joint with no reinforcement as detailed on the Drawings. All costs for keying and reinforcing bars are considered incidental to the Item.
- C. When specified, the Contractor shall reinforce the bottom, side and top of concrete encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy.

### **3.03 DUCTS OR CONDUITS WITHOUT CONCRETE ENCASEMENT**

- A. Trenches for single duct lines shall be not less than 12 inches nor more than 16

inches wide, and the trench for 2 or more ducts installed at the same level shall be proportionately wider. Trench bottoms for ducts without concrete encasement shall be made to conform accurately with the grade so as to provide uniform support for the duct along its entire length.

- B. A layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the duct. The bedding material shall consist of soft sand or other fine fill, and it shall contain no particles that would be retained on a ¼ inch sieve. The bedding material shall be tamped until firm.
- C. Unless otherwise shown in plans, ducts for direct burial shall be installed so that the tops of all ducts are at least 18 inches below the finished grade.
- D. When two or more ducts are installed in the same trench without concrete encasement, they shall be spaced not less than 2 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction.
- E. Trenches shall be opened the complete length between bases, manholes, etc., before duct is installed so that if any obstructions are encountered, proper provisions can be made to avoid them.
- F. Where steel conduits terminate in an unpaved area for transition to direct burial installation, the end of the conduit shall be equipped with an insulated throat, threaded, grounding bushing and shall be connected to the equipment ground.

### **3.04 CORE-DRILLED HOLES**

- A. Certain conduit runs will originate or terminate at existing manholes or light bases. It will be necessary to core-drill into these units to complete the runs. Core-drilled holes into existing manholes or handholes will have the annular space between the conduit and the cored hole filled with mortar.

### **3.05 REAMING EXISTING DUCTS**

- A. In the event that:
  - 1. There are no empty spare ducts that can be utilized,
  - 2. There are no abandoned cables which can be removed,
  - 3. There are no existing cables which can be consolidated to obtain a spare duct:
    - a. When directed by the engineer the Contractor may utilize a mechanical reamer or high-pressure water to ream out the blisters and debris from the duct to make it ready to receive new cables.

### **3.06 ABANDONED DUCT**

- A. When a duct bank is to be abandoned in place, these conduits shall be sealed with grout in the manhole where they originate.

**3.07 COMPLETION OF THE WORK**

- A. After completion of work in any manhole or handhole, both new and existing, the manhole or handhole shall be left in a clean condition satisfactory to the Engineer, regardless of the cause of the debris required to be cleaned.

**END OF SECTION**

## SECTION 16050

### BASIC ELECTRICAL MATERIALS AND METHODS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section includes the following:
1. Raceways.
  2. Building wire and connectors.
  3. Supporting devices for electrical components.
  4. Electrical identification.
  5. Electricity-metering components.
  6. Concrete equipment bases.
  7. Electrical demolition.
  8. Cutting and patching for electrical construction.
  9. Touchup painting.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

##### 1.02 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

##### 1.03 SUBMITTALS

- A. Product Data: For electricity-metering equipment.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### **1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

#### **1.05 COORDINATION**

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
  - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
  - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

### **PART 2 PRODUCTS**

#### **2.01 RACEWAYS**

- A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
- B. FMC: Zinc-coated steel.
- C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
- D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic

jacket.

- E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
- F. Raceway Fittings: Specifically designed for the raceway type with which used.

## **2.02 CONDUCTORS**

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
- B. Conductors, Larger Than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic, rated at 75 degrees C minimum.
- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

## **2.03 SUPPORTING DEVICES**

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.
- D. Slotted-Steel Channel Supports:
  - 1. Channel Thickness: Selected to suit structural loading.
  - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs shall have number and size of conductor gripping holes as required to suit individual risers. Body shall be constructed of malleable-iron casting with hot-dip galvanized finish.
- H. Expansion Anchors: Carbon-steel wedge or sleeve type.
- I. Toggle Bolts: All-steel springhead type.
- J. Powder-Driven Threaded Studs: Heat-treated steel.

## **2.04 ELECTRICAL IDENTIFICATION**

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

- B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
  - 1. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
  - 2. Color: Black letters on orange background.
  - 3. Legend: Indicates voltage.
- C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.
- D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend that indicates type of underground line.
- E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
- H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.
- J. Fasteners for Nameplates and Signs: Self-tapping, stainless steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

## **2.05 TOUCHUP PAINT**

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.



- C. Color shall be as directed by Owner.

### **PART 3 EXECUTION**

#### **3.01 ELECTRICAL EQUIPMENT INSTALLATION**

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

#### **3.02 RACEWAY AND CABLE INSTALLATION**

- A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- B. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- C. Use temporary raceway caps to prevent foreign matter from entering.
- D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
- F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
  - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - 2. Space raceways laterally to prevent voids in concrete.
  - 3. Install conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
  - 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
  - 5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel

raceways.

- G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- H. Install telephone and signal system raceways, 2-inch trade size (DN53) and smaller, in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.
- J. Set floor boxes level and trim after installation to fit flush to finished floor surface.

### **3. 03 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS**

- A. Feeders: Type THHN/THWN-2 insulated conductors in raceway.
- B. Underground Feeders and Branch Circuits: Type THWN-2 or single-wire, Type UF insulated conductors in raceway.
- C. Branch Circuits: Type THHN/THWN-2 insulated conductors in raceway.
- D. Branch Circuits: Type THW or THHN/THWN-2 insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.
- E. Branch Circuits: Type THW or THHN/THWN-2 insulated conductors in raceway where exposed. Armored or nonmetallic sheathed cable where permitted by authorities having jurisdiction and where concealed in ceilings and gypsum board partitions.
- F. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN-2 insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

### **3. 04 WIRING INSTALLATION**

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

### **3.05 ELECTRICAL SUPPORTING DEVICE APPLICATION**

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

### **3.06 SUPPORT INSTALLATION**

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of

adequate strength.

- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts.
  - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
  - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
    - a. Field Welding: Comply with AWS D1.1.
  - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
  - 8. Light Steel: Sheet-metal screws.
  - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### **3.07 IDENTIFICATION MATERIALS AND DEVICES**

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:
  - 1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
  - 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-

- foot (8-m) maximum intervals in congested areas.
3. Colors: As follows:
    - a. Fire Alarm System: Red.
    - b. Security System: Blue and yellow.
    - c. Telecommunication System: Green and yellow.
  - E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
  - F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.
  - G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
    1. Phase A: Black.
    2. Phase B: Red.
    3. Phase C: Blue.
  - H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
    1. Phase A: Yellow.
    2. Phase B: Brown.
    3. Phase C: Orange.
    4. Coordinate two paragraphs below with Drawings.
  - I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
  - J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

### **3.08 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT**

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

### **3.09 FIRESTOPPING**

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

### **3.10 CONCRETE BASES**

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

### **3.11 CUTTING AND PATCHING**

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.
- C. Provide additional means and materials that shall contain dust and debris.

### **3.12 FIELD QUALITY CONTROL**

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Raceways.
  - 2. Building wire and connectors.
  - 3. Supporting devices for electrical components.
  - 4. Electrical identification.
  - 5. Electricity-metering components.
  - 6. Concrete bases.
  - 7. Electrical demolition.
  - 8. Cutting and patching for electrical construction.
  - 9. Touchup painting.
- B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
  - 1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit

supplied by the metered feeder.

2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

### **3.13 REFINISHING AND TOUCHUP PAINTING**

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Field Painting."
  1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### **3.14 CLEANING AND PROTECTION**

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

**SECTION 16060**  
**GROUNDING AND BONDING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes grounding electrodes and conductors, equipment grounding conductors and bonding. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.02 SUBMITTALS**

- A. Data Sheets: Submit as a minimum the following information on each different item. The information shall be in the form of a manufacturer's standard data sheets.
  - 1. Rod Electrodes.
  - 2. Rod Material.
  - 3. Dimensions.
  - 4. Coupling Type.
  - 5. Mechanical Connectors.
  - 6. Material.
  - 7. Connector Type.
  - 8. Exothermic Connections.
  - 9. Process Description.
  - 10. Mold Types.
  - 11. Weld Material.
  - 12. Starting Material.
  - 13. Ground Well.
  - 14. Dimensioned Picture or Drawing of Grounding Well and Cover.
  - 15. Well Pipe Material.
  - 16. Well Cover Material and Legend.
- B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.



- C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

### **1.03 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.
- C. IEEE Std 81 – Guide.
- D. UL 467 – Electrical Grounding and Bonding Equipment.
- E. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- F. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

## **PART 2 PRODUCTS**

### **2.01 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Division 16 Section "600 Volt or Less Cable."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
  - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4-inch in diameter.
  - 2. Bonding Conductor: No. 4 AWG, stranded copper conductor.
  - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

### **2.02 CONNECTOR PRODUCTS**

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and

combinations of conductors and connected items.

- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

### **2.03 GROUNDING ELECTRODES**

- A. Ground Rods: Size:  $\frac{3}{4}$ " diameter by 120 inches. Copper clad steel sectional type with high strength steel core and electrolytic grade copper outer sheath, molten welded to the core with tapered point.

### **2.04 EXOTHERMIC CONNECTIONS**

- A. UL 486A.
- B. Process: Exothermic process that produces molecular bonding of connected items.
- C. Approved for exposure or direct burial without degradation.
- D. Use graphite molds of proper size and design for the weld and connected items.
- E. Starting Weld material: Copper oxide and aluminum mixture with a minimum 3 percent tin.
- F. Weld material: Aluminum, copper and iron oxides ignited only by spark ignitor designed for the purpose.
- G. Miscellaneous: Provide tools and other devices required for a complete weld.
- H. All welding material shall be of the same manufacturer.

### **2.05 WIRE**

- A. UL 486A.
- B. Materials: Copper, 98 percent conductivity; insulated copper for all feeders, branch circuits; bonding jumpers and transformer grounds; solid for #10 AWG and smaller, stranded for larger than #10 AWG. See Section 16123 for insulation types.
- C. Foundation Electrodes: Bare, tinned, stranded copper #4/0 AWG.
- D. Grounding Electrode Conductor: Insulated copper, size as indicated.
- E. Counterpoise: Bare, tinned stranded, copper, #3/0 AWG.

### **2.06 GROUNDING WELL**

- A. UL 467.
- B. Well Pipe: 8-inch diameter by 36-inch long concrete pipe with belled end.
- C. Well Cover: Cast iron with legend "GROUND" embossed on cover.

## **2.07 GROUND BUS BARS**

- A. Building Master Ground Bar – MGB:
  - 1. Tin plated copper ground bar.
  - 2. ¼-inch thick.
  - 3. 4-inch wide with two sets of holes drilled and tapped.
  - 4. Minimum 4-foot long unless otherwise indicated on the Drawings.
  - 5. Wall mounted on 2-inch insulated standoffs.

## **PART 3 EXECUTION**

### **3.01 APPLICATION**

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- F. Ground Bus Bars: Install in each electrical and communication rooms and elsewhere as indicated.
  - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
  - 2. At doors, route the bus up to the top of the doorframe, across the top of the doorway, and down to the specified height above the floor.

### **3.02 EQUIPMENT GROUNDING CONDUCTORS**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install insulated equipment grounding conductors in all raceways. Terminate each end on suitable lug, bus or bushing.
- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for voice and data cables.
- D. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

- E. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- F. Where expansion joints or telescoping joints occur, provide bonding jumpers.
- G. Where flexible metallic conduit is employed, provide a green insulated grounding jumper installed in the flexible conduit.
- H. Provide grounding bushings on all service and feeder raceways terminating within switchboards, motor control centers, panelboards, cabinets, and all other enclosures. Provide grounding conductors from such bushings to the frame of the enclosure and to the ground bus or equipment grounding strap.
- I. Where paralleled conductors in separate raceways occur, provide grounding conductor in each raceway.

### **3.03 COUNTERPOISE**

- A. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 3/0 AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 18 inches below grade and 24 inches from building foundation.

### **3.04 INSTALLATION**

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
  - 1. Drive ground rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated. Proper driving studs and sleeves shall be used when driving ground rods. Water shall be continuously applied to the ground at point where the rod penetrates during the driving process.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in

locations accessible for maintenance.

- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor in addition to test well shown on drawings.

### 3.05 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Use exothermic welded connections for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and other electrodes. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may

be terminated with winged pressure-type connectors.

- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### **3.06 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING**

- A. Duct Banks: Install a grounding conductor with at least 50 percent ampacity of the largest phase conductor in the duct bank.
- B. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- C. Pad-Mounted Service Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation.

### **3.07 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing grounding system but before permanent electrical circuitry

has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE Standard 81.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
  - a. Equipment Rated 500 kVA and Less: 10 ohms.
  - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
  - c. Equipment Rated More Than 1000 kVA: 3 ohms.
  - d. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values. Install additional rod electrodes or add additional sections of a sectional type rod as required to achieve specified resistance to ground.

**END OF SECTION**

## SECTION 16123

### 600 VOLT OR LESS CABLE

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section includes requirements for insulated copper stranded conductors and associated connections for general power and control use at voltages below 600 volts.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and other Specification Sections, apply to the Work as if specified in this Section.

##### 1.02 REFERENCES

- A. ASTM (American Society for Testing and Materials) - B3, B8.
- B. NECA (National Electrical Contractors Association) – National Electrical Installation Standards.
- C. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- D. NEMA WC 26 - (1996) Wire and Cable Packaging.
- E. NFPA 70 – (1999) National Electrical Code.
- F. UL 83 - (1991; Rev. through Mar. 1996) Thermoplastic – Insulated Wires and Cables.
- G. UL 486A – (1991; Rev. Oct. 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- H. UL 510 – (1994) Insulating Tape.

##### 1.03 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wire and cable that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for specific types, sizes, and combinations of conductors and connected items.
- B. Comply with NFPA 70. Products shall bear the UL label.
- C. Perform work in accordance with codes and standards listed.
- D. Wire shall be manufactured within 12 months prior to the date of delivery to the site.

##### 1.04 SUBMITTALS

- A. Data Sheets: Submit as a minimum the following information on each different type of wire and connector. The information shall be in the form of manufacturer's



standard data sheets or drawings.

1. Wire and cable.
  2. Conductor material.
  3. Conductor gage or MCM.
  4. Solid or stranded conductor.
  5. Insulation material.
  6. Insulation type designation.
  7. Insulation temperature rating.
- B. Wiring Connectors:
1. Connector type.
  2. Connector material.
  3. Voltage, amperage, and temperature ratings.
  4. Conductor size ranges.
  5. Tools required.
  6. Picture of connector and tools.
  7. Manufacturer's installation instructions.
- C. Heat Shrink Material:
1. Type of material.
  2. Wall thickness.
  3. Voltage and temperature ratings.
  4. Conductor size ranges.
  5. Tools required.
  6. Picture of material and tools.
  7. Manufacturer's installation instructions.
- D. Insulating Tape:
1. Type of material.
  2. Thickness and width.
  3. Wire pulling lubricants.
  4. Type of material.
  5. Types of conductor, insulation and conduit for which it is approved.
- E. Megger Test Reports: Indicate values obtained.
- F. Manufacturer's Installation Instructions: Indicate application conditions and

limitations of use stipulated by product testing agency specified under Codes and Standards.

### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wire and cables according to NEMA WC 26.

## **PART 2 PRODUCTS**

### **2.01 BUILDING WIRE AND CABLE**

- A. Description: UL 83, single conductor insulated wire.
1. Conductor: Copper; 98 percent conductivity; solid for 10 AWG or smaller; stranded for larger than 10 AWG as applicable.
  2. Insulation Thermoplastic: 600 volts, NFPA 70, Type THHN/THWN-2, XHHW unless otherwise indicated; 75° C or 90° C.
  3. All building wire shall be of the same manufacturer. Do not mix wire of different manufacturer on the same project.
  4. General: All wire shall be identified as required by NEC.
  5. The insulation on wiring #8 or smaller shall have factory-colored insulation. For wire larger than #8, color-coding shall be colored tape wrapped around the insulation of each wire at each connection, splice and pull box. Each phase conductor of each branch circuit shall be of one color throughout the installation.

- (1) Color coding shall be as described in section 16050 "Basic Electrical Materials and Methods".

### **2.02 CONTROL WIRE**

- A. Description: UL 83, single conductor insulated wire.
1. Conductor: Copper; stranded for all sizes.
  2. Insulation: Thermoplastic; 600, NFPA 70 Type MTW unless otherwise indicated; 75° C or 90° C as applicable.
  3. All control wire shall be of the same manufacturer.
  4. Identification: Control wire shall be color-coded throughout. Each wire shall be identified at each terminal and junction point by permanently attaching wire markers indicated the terminal number, etc. Refer to Section 16050 – for Electrical Identification requirements.

### **2.03 WIRING CONNECTORS**

- A. Solderless Spring-Wire Connectors: UL 486A, tool-applied, twist-on type with plastic caps; rated for conductor sizes and material.

- B. Compression Connectors and Taps: Mechanical set screw type or tool-applied crimp type. Split bolt connectors are not acceptable.

## **2.04 ACCESSORIES**

- A. Heat Shrink Material: Heavy wall tubing or caps; UL listed as waterproof.
- B. Insulating Type: Vinyl type; minimum 7-mil; listed for use as primary insulation and splice jacketing on 600 volt wire and cable.
- C. Wire Pulling Lubricants: Compatible with all conductor, insulation and conduit types.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Completely and thoroughly swab raceway where moisture and/or dirt has collected inside before installing wire.
- B. Do not install wire in conduit, raceways, etc. until they are complete and sealed against the entry of moisture and/or debris.

### **3.02 WIRING METHODS**

- A. Concealed Dry Interior Locations: Use only building wire, type THHN/THWN-2 or XHHW insulation, in raceway.
- B. Exposed Dry Interior Locations: Use only building wire, type THHN/THWN-2 or XHHW insulation in raceway.
- C. Wet or Damp Interior Locations: Use only building wire type THHN/THWN-2 or XHHW insulation in raceway.
- D. Exterior Locations: Use only building wire, type THHN/THWN-2 or XHHW insulation in raceway.
- E. Underground Installations: Use only building wire, type THHN/THWN-2 or XHHW insulation in raceway.
- F. Use wiring methods in accordance with the appropriate article of NFPA 70.
- G. Connect each circuit of a multi-circuit home run to a different phase.
- H. Do not terminate more than one conductor in a single terminal of a lug or connector.
- I. Leave slack conductor at each connection and splice to allow for future additional connections.

### **3.03 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install all wiring in raceways. As standard practice, route control conductors in

separate raceways from power conductors. When engineering consideration dictates, control conductors may be routed in power raceway under the following conditions:

1. All conductors must have insulation rated for the highest voltage rated insulation in the raceway.
  2. The largest power conductor in the raceway is #4 or smaller.
- C. Use conductor not smaller than #12 AWG for power and lighting circuits.
- D. Use conductor not smaller than #14 AWG for control circuits.
- E. Use #10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 115 feet to the furthest outlet.
- F. Use #10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 265 feet to the furthest fixture.
- G. Pull all conductors into raceway at the same time.
- H. Use suitable wire pulling lubricant.
- I. Use a pulling means such as tape, rope, grips, etc. that will not damage the wire, cable or conduit.
- J. Neatly train and lace wiring inside boxes, equipment, cabinets, switchboards, and panelboards with nylon tie straps. Three phase circuits shall be grouped by circuit.
- K. Clean conductor surfaces before installing lugs and connectors.
- L. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- M. Tighten set screws and bolts on connectors according to the manufacturer's torquing requirements.
- N. Use compression connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of the conductor.
- O. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, #10 AWG and smaller.
- P. Where splices and taps are made in junction boxes or handholes, etc. below grade, use tool-applied crimp type compression connectors. Insulate the conductors and the connector with heavy wall heat shrink material.
- Q. For parallel conductors of a single phase, insure that conductor lengths are equal by actual length comparison before installation.
- R. Provide phase testing for proper rotation of all motors.
- S. Seal around cables penetrating fire-rated elements.
- T. Splices in raceways are not allowed. Splice only in junction or outlet boxes in accessible locations.

- U. Wiring at Outlets: Install conductors at each outlet with at least 6 inches of slack.
- V. Provide green colored conductor insulation for the entire length of the grounding conductors for wire size smaller than #6 AWG.
- W. Provide white colored conductor insulation for the entire length of the neutral conductors for wire size smaller than #6 AWG.

### **3.04 IDENTIFICATION**

- A. Identify wires and cables in accordance with Section 16050.
- B. In pull or junction boxes where there is more than one circuit, identify each conductor with its panel and circuit number or other designation indicated on drawings.

### **3.05 WIRING TEST**

- A. Measure the insulation resistance of all feeder conductors using a "Megger." The test voltage shall be 500 volts. Test the conductor without circuit loads applied. The minimum resistance value shall be 1,000,000 ohms.

### **3.06 FIELD QUALITY CONTROL**

- A. Inspect wire for physical damage and proper connection.
- B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- C. Verify continuity of each branch circuit conductor.

**END OF SECTION**

## SECTION 16130

### RACEWAYS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section includes rigid metal conduit, intermediate metal conduit, flexible metal conduit, liquid tight flexible metal conduit, electrical metallic tubing, rigid PVC conduit, fitting and conduit bodies.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections apply to the work of this Section as if specified herein.

##### 1.02 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. LFMC: Liquidtight flexible metal conduit.
- D. PVC: Polyvinyl chloride.
- E. RGS: Rigid galvanized steel.
- F. FMC: Flexible metal conduit.
- G. EPT: Electrical polyvinyl chloride tubing.

##### 1.03 SUBMITTALS

- A. Data Sheets: Submit as a minimum the following information for each type of conduit, conduit body, fitting and attachment device.
  - 1. Conduit.
    - a. Type of material.
    - b. Thickness of material.
    - c. Types of protective coatings on the outside and inside.
    - d. Type of protective coating on threads, if applicable.
  - 2. Conduit Bodies:
    - a. Type of material.
    - b. Type of cover material.
    - c. Type of protective coatings, interior and exterior.
    - d. Type of material for screws and gaskets.

3. Conduit Fittings:
  - a. Type of materials such as bodies, gaskets, seals, etc.
  - b. Threaded.
  - c. Compression or set screw type.
  - d. Liquid tight.
  - e. Concrete tight.

#### **1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100. Products shall be the UL label.
- B. Comply with NFPA 70.
- C. ANSI C80.1: Rigid Steel Conduit, Zinc Coated.
- D. ANSI C80.3: Electrical Metallic Tubing, Zinc Coated.
- E. ANSI C80.6: Intermediate Metal Conduit (IMC).
- F. ANSI/NEMA FB I: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- G. NECA: "Standard Installations."
- H. NEMA RN 1: Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- I. NEMA TC 2: Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- J. NEMA TC 3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- K. UL 1: Flexible Metal Conduit.
- L. UL 6: Rigid Metal Conduit.
- M. UL 360: Liquid Tight Flexible Steel Conduit.
- N. UL 514B: Fittings for Conduit and Outlet Boxes.
- O. UL 651: Schedule 40 and 80 Rigid PVC Conduit.
- P. UL 797: Electrical Metallic Tubing.
- Q. UL 886: Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.
- R. UL 1242: Intermediate Metal Conduit.

#### **1.05 COORDINATION**

- A. Coordinate layout and installation of raceways, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, communication system, HVAC equipment, fire-suppression system, and partition assemblies.

## **1.06 DELIVERY STORAGE AND HANDLING**

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. The threads of rigid steel and IMC shall be protected by factory installed caps.
- C. Protect PVC conduit from sunlight.

## **PART 2 PRODUCTS**

### **2.01 METAL CONDUIT**

- A. Rigid Steel Conduit (RSC): ANSI C80.1, RSC shall be threaded, hot dip galvanized inside and outside with a chromate coating outside. Threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.
- B. Intermediate Metal Conduit (IMC): ANSI C80.6, IMC shall be threaded, hot dip or electro-galvanized outside with chromate coating. The inside shall be galvanized or coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth, low friction surface. The threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.
- C. Couplings: Couplings shall be threaded, hot dip or electro-galvanized steel with chromate coating and made by the same manufacturer as the conduit.

### **2.02 PVC COATED METAL CONDUIT**

- A. Description: NEMA RN 1, conduit shall be rigid steel, hot dip galvanized inside and outside including the threads. The exterior surface shall be treated prior to coating. Both interior and exterior shall be coated with an epoxy acrylic primer. The exterior shall be coated with a minimum 40-mil thick PVC coating. The interior shall be coated with a nominal 2-mil thick urethane coating. The conduit shall be bendable without damage to either the PVC or urethane coating. The threads shall be coated with a nominal 2-mil thick clear urethane coating. Elbows and nipples shall conform to the same specification.
- B. Couplings, Fittings and Conduit Bodies:
  - 1. Couplings shall be galvanized steel and made by the same manufacturer as the conduit.
  - 2. Fittings shall be malleable iron or steel.
  - 3. Conduit bodies shall be copper free cast aluminum or malleable iron with cast covers and stainless steel screws.
  - 4. All couplings, conduit fittings and conduit bodies shall have the same exterior and interior coatings as specified for the conduit.
  - 5. The exterior PVC material shall form a sleeve extending one pipe



diameter or 2 inches, whichever is less, from each female opening of couplings, fittings and conduit bodies.

6. Clamps, U-bolts, and other devices used to secure the conduit shall be malleable iron or steel with the same PVC coating as the conduit.
7. Couplings, fittings, and conduit bodies shall be of the same manufacturer as the conduit.

## **2.03 FLEXIBLE METAL CONDUIT**

- A. Description: UL 1, interlocked galvanized steel.

## **2.04 LIQUID TIGHT FLEXIBLE METAL CONDUIT**

- A. Description: UL 360, interlocked galvanized steel with extruded PVC jacket.

## **2.05 ELECTRICAL METALLIC TUBING (EMT)**

- A. Description: ANSI C80.3, EMT shall be hot dip or electro-galvanized on the outside with a chromate coating. The interior shall be coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth low friction surface.

## **2.06 NONMETALLIC CONDUIT**

- A. Description: PVC; Schedule 40.
- B. Fittings: Fittings shall match conduit type and material and shall be provided by the same manufacturer as the conduit.
- C. Cement for connections of conduit and fittings shall be approved by the manufacturer of the conduit.

## **2.07 FITTINGS AND CONDUIT BODIES FOR METAL, EMT AND FLEXIBLE CONDUIT**

- A. Fittings:
  1. All fittings, locknuts, bushings, etc. shall be malleable iron or steel.
  2. For RSC or IMC, fittings shall be threaded type.
  3. For EMT, fittings shall be compression type.
  4. Locknuts shall have shape edges that bite into the enclosure when tightened.
  5. Bushings shall be high temperature plastic, with insulating throats and grounding lugs where applicable.
  6. Hub fittings shall be two-piece, liquid-tight with high temperature, plastic, insulating throats.
  7. Fittings used in concrete shall be UL listed as concrete tight.
  8. Fittings used in exterior and other damp or wet applications shall be UL

- listed as liquid-tight.
9. Fittings for flexible metal conduit shall have insulated throats and grounding lugs where applicable.
  10. Refer to the PVC coated metal conduit and nonmetallic conduit specifications for fittings used with those types of conduit.
  11. Sealing bushings shall have molded neoprene sealing ring with predrilled holes for each conductor, PVC coated pressure discs, stainless steel screws and washers and locking ring where applicable.
- B. Conduit Bodies: Conduit bodies shall be malleable iron or cast copper-free aluminum. They shall be threaded type with cast cover and solid gasket. Where used in dry interior applications, provide coated steel screws. Where used in exterior or other damp or wet applications, use stainless steel screws. Conduit bodies 1 ¼ inches and larger shall have rollers or wire guards.
- C. Expansion Fittings: Expansion fittings shall be malleable iron or steel with insulator bushing, gaskets, washers, packing, etc. as required to provide a complete unit. Provide a braided copper bonding jumper. The fittings shall be rated for interior or exterior use as applicable.
- D. Seal Fittings: Seal fittings shall be malleable iron or cast aluminum, threaded type with packing, sealing compound, plugs, etc. to provide a complete unit. Fittings shall be rated for interior or exterior use as applicable.
- E. Deflection Fittings: Deflection fittings shall be hot dip galvanized ductile iron, threaded type with molded neoprene outer jacket, tinned braided copper bonding jumper, molded plastic inter sleeve, stainless steel clamping bands, etc. to provide a complete unit. The fitting shall be rated for interior or exterior use as applicable. Where fittings are used below grade, they shall be PVC coated as specified under PVC coated metal conduit fittings.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Underground Installation: Use schedule 80 PVC where direct buried and schedule 40 PVC where encased in concrete.
- B. Outdoor Locations, Above Grade: Use coated rigid steel conduit and flexible waterproof conduit for connection to motors and control devices.
- C. Wet and Damp Locations, Above Grade: Use coated rigid steel conduit, flexible waterproof conduit for connection to motors and control devices.
- D. Dry Locations:
  1. Concealed in Concrete or Masonry Construction Above Grade, Columns, Walls and Above Suspended Ceilings: Use rigid steel conduit, intermediate metal conduit, and electrical metallic tubing.

2. Exposed: Use rigid steel, intermediate metal conduit, and electrical metallic tubing.
- E. Locations Subject to Physical Damage: Use rigid steel conduit or intermediate metal conduit.
- F. Corrosive Environments: Use PVC coated rigid steel.
- G. In Refrigerated or Hazardous Areas: Use rigid steel or intermediate metal conduit.
- H. Service Entrance Conduit – Underground (600 volts or less): Use schedule 80 PVC with the underground portion encased in a minimum 3 inches of concrete and installed a minimum of 24 inches below grade. Convert PVC conduit to rigid galvanized steel before rising through the floor slab or grade. The PVC coated rigid steel conduit shall extend a minimum of 6 inches above the floor or grade.
- I. Flexible Metal Conduit: Flexible metal conduit shall be installed for:
  1. Connections from the conduit system to recessed lighting fixtures, maximum 6 feet in length.
  2. Connections to motors, maximum 2 feet in length.
  3. Connections to electrical equipment subject to movement or vibration.
- J. Liquid-Tight Flexible Metal Conduit: Liquid-tight flexible metal conduit shall be installed for:
  1. Connections to motor equipment subject to movement or vibration where exposed to rain, spray, or a corrosive atmosphere.
  2. Connections to equipment subject to oil or grease.
  3. Connections to control equipment.
- K. General Requirements:
  1. Install conduit in accordance with NECA “Standard of Installation” and manufacturer’s written instructions.
  2. Install nonmetallic conduit in accordance with manufacturer’s instructions.
  3. Minimum Conduit Size: ¾-inch unless otherwise specified.
  4. Verify routing and termination requirements and locations of conduit prior to rough-in.
  5. Routing and termination of conduits shall be coordinated with structural, equipment, piping and ductwork to assure accessibility to junction and pull boxes.
  6. Conduit routing shown on the drawings is diagrammatic unless otherwise dimensioned. Route conduit as specified and as required. Conduit offsets, risers, junction boxes, pull boxes, and fittings are not necessarily shown; however, provide these as required by the conditions involved and

applicable codes for a correct and complete installation.

7. Finished Areas: Conceal conduits below floors, within slabs only where indicated, within walls, within pipe chases, above suspended ceilings, and within other building construction, unless otherwise indicated. Conduits shall be run in floor slabs except where otherwise indicated.
8. Unfinished Areas: Install above floor conduits exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impractical, in mechanical and electrical equipment rooms, and other unfinished areas.
9. Install conduit runs exposed or concealed above ceilings or in walls in straight, level and plumb lines, parallel with and at right angles with beams, wall, ceilings and other building lines.
10. Route conduit in slabs above grade and in and under slabs on grade from point-to-point or shortest practical path.
11. Arrange conduit supports to prevent misalignment during wiring installation.
12. Support individual conduit using coated steel or malleable two-hole conduit straps, lay-in adjustable hangers, clevis hangers, threaded rods with conduit fasteners and split hangers.
13. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits. Each conduit shall be independently attached to the rack.
14. Fasten conduit supports to building structure. Do not fasten conduit supports to mechanical piping or ducts or their supports.
15. Do not support conduit with the tie wire or perforated pipe straps. Remove wire used for temporary supports.
16. Do not cross conduits in slab.
17. Conduit shall be installed a minimum of 12 inches from steam or hot water piping, flues or any other surface with a surface temperature exceeding 104° F (40° C) run in parallel with the conduit, and a minimum of 6 inches where run perpendicular to the conduit. Conduit shall be installed a minimum of 3 inches from cold or chilled water piping.
18. Cut conduit square using saw or pipecutter; ream and de-burr cut ends.
19. Bring conduit to shoulder of fittings; fasten wrench-tight.
20. When threads are cut in rigid steel or intermediate metal conduit in the field, the conduit and fittings shall be made up immediately. If there are any showing, they shall be coated with a corrosion resistant compound approved by the conduit manufacturer.
21. When threads are cut in PVC coated rigid steel conduit in the field, the threads shall be coated immediately with a corrosion resistant compound

- supplied by the conduit manufacturer. When the PVC coating of the conduit is removed or damaged for any reason, the exposed area shall be coated with a PVC compound supplied by the conduit manufacturer. Follow the manufacturer's instructions in applying compounds.
22. Solvent weld nonmetallic conduit and fittings using cement as approved by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fittings. Allow joint to cure as instructed by the manufacturer.
  23. Use conduit hubs or watertight fittings to fasten conduit to metal boxes in damp and wet locations.
  24. In general, install no more than equivalent of three 90° bends between pull or outlet boxes. For communication conduits, install no more than equivalent of two 90° bends between pull or outlet boxes. Make field-made bends and offsets with hickey or conduit bending machine. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size. Do not install crushed or deformed conduits. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. For banked runs, all bends and offsets shall be parallel.
  25. Avoid moisture traps; provide junction box with drain fitting at low point in conduit system.
  26. Provide approved adapters when PVC conduits are coupled to metallic conduits.
  27. Where PVC is used underground, a PVC coated rigid steel elbow shall be provided at the point where the conduit turns up. The vertical portion of the riser shall be PVC coated rigid steel conduit.
  28. Provide approved fittings that maintain conduit electrical continuity by bonding jumpers or other means to accommodate expansion and deflection where conduit crosses control and expansion joints.
  29. Provide seal fittings on all conduits where they rise out of the ground or fill below slabs. If the conduit terminates in a floor mounted metal enclosure such as a switchboard, pull box, etc., provide a sealing bushing with a grounding bushing.
  30. Provide seal fittings on all conduits that penetrate exterior walls or to or from interior spaces or other areas where conduit passes from one extreme temperature or moisture situation to another such as walk-in refrigerators, freezers or wash down bays.
  31. Install a pull rope in each empty conduit. Pull rope shall be monofilament plastic having a minimum 200-lb. tensile strength. Leave a minimum of 12 inches of slack at each end of the pull line and securely fasten pull rope to conduit.
  32. Where conduits rise through floor slabs, curved portions or bends shall not

- be visible above the finished slab.
33. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms.
  34. Support horizontal and vertical runs of conduit at intervals in accordance with the code for the types of conduit used. In addition, support each riser conduit at each building floor level.
  35. Prior to wire pulling, use suitable caps to protect installed conduit against entrance of dirt and moisture and blow out or swab out conduits in which moisture or dirt has collected. Free clogged conduits of obstructions.
  36. Ground and bond conduit under provisions of Section 16060 - Grounding and Bonding.
  37. Identify conduit under provisions of Section within 16050 – Electrical Identification.
  38. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction where conduit and other electrical items are not installed prior to concrete beams shall be NPS steel pipe or rigid steel conduit, flush with finished concrete surfaces. Sleeves for all conduits passing through the floor shall be galvanized NPS pipe or galvanized rigid steel conduit extending two inches above finished floor, and flush with slab below.
  39. Install conduit to preserve fire and smoke resistance rating of partitions and floors.
  40. Route conduit through suitable roof flashing devices. Coordinate with roofing installation.
  41. Provide insulating bushings on all feeder conduits.
  42. Provide code size pull boxes, in accessible locations, in all conduits where the number and degree of bends exceed the code limitations and every 150 feet maximum for long straight runs.
  43. All conduits that are stubbed out below grade shall have a threaded, watertight cap installed on the end.
  44. Conduits shall be located so as not to hinder access to mechanical and electrical equipment through the ceiling tiles.
  45. Exposed suspended conduits shall be located as to provide proper headroom as required by OSHA regulations.
  46. Conduit runs shall be complete before conductors are installed in them.
  47. Tighten set screws of threadless fittings with suitable tools.
  48. Terminations:
    - a. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part

- against box. Use two locknuts, one inside and one outside box.
- b. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
49. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches of slack at each end of pull wire.
  50. Control System Raceways, 2-Inch Trade Size (DN 53) and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
  51. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    - b. Where otherwise required by NFPA 70.
  52. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
  53. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
  54. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

### **3.02 EXCAVATION AND BACKFILL**

- A. Excavate and backfill as required for the electrical work (coordinate with utilities). Cut bottoms of trenches to the proper lines and grades to provide firm and continuous support for the underground electrical work, and to provide 24-inch MINIMUM depth or as required by the NEC if more than 24 inches from

finished grade to tops of all exterior underground electrical work. Sheet and brace excavations as required to protect personnel and adjacent structures.

1. After the underground electrical work has been installed and approved, place all backfill in 8-inch maximum thickness loose layers, and compact each layer to at least the density of the adjacent undisturbed site soil, using pneumatic or other suitable power tampers. Mass backfilling (backfilling without tamping) is prohibited.
2. Warning tape for buried electrical work: Install detectable warning tape directly over every device by burying tape as close to the surface as possible, but no less than 6 inches beneath finish grade. One strip of warning tape shall be placed parallel and directly above the conduit. Where conduits are banked and the width of the conduit bank is over 12 inches, strips shall be placed parallel, on 12-inch centers, centered directly above the conduit bank. Refer to Section 16195 – Electrical Identification.

**B. Conduits Embedded in Slabs:**

1. Conduits shall be installed in slabs only where indicated.
2. Install in middle third of the slab thickness where practical, and leave a minimum of 1-inch concrete covers.
3. Do not stack conduits.
4. Outside diameter of the conduit shall not exceed 1/3 of the slab thickness.
5. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
6. Space raceways laterally to prevent voids in the concrete. Conduits shall be spaced no closer than 3 diameters on center except at cabinet locations.
7. Run conduit larger than 1-inch trade size parallel to or at tight right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.

**3.03 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings, and finishes are without damage or deterioration at time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

**3.04 CLEANING**

- A. After completing installation of exposed, factory-finished raceways, inspect exposed finishes and repair damaged finishes.



**END OF SECTION**

## SECTION 16135

### BOXES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. The work included under this Section consists of furnishing and installing outlet boxes, including all related systems and accessories as shown on the Drawings and hereinafter specified.

##### 1.02 QUALITY ASSURANCE

- A. Manufacturer: Firms regularly engaged in manufacture of electrical boxes of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. ANSI/NEMA Standards Compliance: Comply with ANSIC 134.1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports.
- C. Furnish products listed and classified by UL as suitable for purpose specified and indicated. Products shall bear the UL label.

##### 1.03 SUBMITTALS

- A. Data Sheets: Submit as a minimum the following information on each different type of outlet, floor, pull and junction box. The information shall be in the form of manufacturer's standard data sheet or drawings or shop drawings.
  - 1. Box material.
  - 2. Wall or sheet metal thickness.
  - 3. Dimensions.
  - 4. Hub or knockout sizes.
  - 5. Gasket material.
  - 6. Polished stainless steel cover plate material and thickness.
  - 7. Picture of the box.

#### PART 2 PRODUCTS

##### 2.01 OUTLET BOXES

- A. Interior Outlet Boxes: UL 514A, provide galvanized flat rolled sheet steel interior outlet wiring boxes, of types, shapes and sizes, including box depths, to suit each

respective location and installation; construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

- B. Interior Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations. Choice of accessories is Installer's option.
- C. Weatherproof Outlet Boxes: Provide corrosion-resistant galvanized or cadmium plated cast-iron weatherproof outlet wiring boxes, of types, shapes and sizes, including depths of boxes, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners.
- D. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of types, shapes and sizes, to suit respective locations and installation, construct with threaded conduit entrance ends, removable covers, and corrosion-resistant screws.
- E. Bushing, Knockout Closures and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes to suit respective uses and installation.
- F. At each outlet shown, provide a box of suitable size and construction to serve the purpose properly. Furnish and install plaster rings where required in connection with adjacent plaster finishes where these occur. In unfinished masonry walls furnish and install boxes of such size as to permit their being completely covered by the device plate. Boxes throughout shall be galvanized steel. All unused knockouts in boxes shall be filled or capped before plates or devices are installed.
- G. Outlet boxes for all exposed work shall be of the cast iron type. Provide gasketed cover by box manufacturer. Provide the threaded hubs.

## **2.02 FLOOR BOXES**

- A. Floor Boxes: UL 514A, fully adjustable with leveling screws and adjusting rings.
- B. Material: Cast Metal or Formed Steel.
- C. Shape: Rectangular.
- D. Conform to regulatory requirements for concrete-tight floor boxes.
- E. Service Fittings: Refer to Section 16140 – Wiring Devices.

## **2.03 PULL AND JUNCTION BOXES**

- A. Sheet Metal Boxes: NEMA 1, galvanized steel, unless otherwise noted on drawings.
- B. Surface-Mounted Cast Metal Box: NEMA, Type 4; flat-flanged, surface mounted junction.
  - 1. Material: Galvanized cast iron or cast aluminum.

2. Cover: Furnish with ground flange, neoprene gasket and stainless steel cover screws.
- C. In-Ground Cast Metal Box: NEMA, Type 6, outside flanged, recessed cover box for flush mounting where indicated:
  1. Material: Galvanized cast iron.
  2. Cover: Galvanized cast iron cover with neoprene gasket and stainless steel cover screws. Cover shall be smooth for below grade applications and nonskid for flush mounted applications.
  3. Cover Legend: As indicated.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION OF ELECTRICAL BOXES**

- A. Verify locations of floor boxes and outlets prior to rough-in.
- B. Install electrical boxes complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in compliance with recognized industry practices.
- C. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
- D. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
- E. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- F. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.
- G. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.
- H. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Provide electrical connections for installed boxes.
- I. All switch outlets boxes shall be flush with wall mounted top 48" above the floor. All receptacle and communication outlets boxes shall be flush with wall mounted bottom 16" above the floor unless otherwise noted on the Drawings.
- J. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- K. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

- L. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- M. Install boxes to preserve fire resistance rating of partitions and other elements.
- N. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices.
- O. Use flush mounting outlet boxes in finished areas.
- P. Secure flush mounting box to interior wall and partition studs. Flush boxes in partitions of light steel construction shall be supported by bar hangers with 25 mm (1 inch) long studs or metal box mounting brackets. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the bracket. This additional box support shall consist of a 300 mm (12 inch) long section of wall stud, bracketed to the opposite side of the box. Accurately position to allow for surface finish thickness.
- Q. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- R. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- S. Use adjustable steel channel fasteners for hung ceiling outlet box. Channel fasteners shall be attached to the main runners or supports. The fastener shall be secured to the tee bar or ceiling support with a screw run through the tee bar or support and the fastener at each point at which it is attached.
- T. Support boxes to or from the structure independent of conduit, except cast outlet boxes that are connected to two rigid metal conduits both supported within 12 inches of box.
- U. Use gang box where more than one device is mounted together. Do not use sectional box.
- V. Use gang box with plaster ring for single device outlets.
- W. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- X. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- Y. Set floor boxes level.
- Z. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
  - 1. Interior Dry Locations: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
  - 2. Other Locations: Use surface mounted cast metal box.
- AA. All pull boxes and junction boxes shall be identified as to their contents. Boxes for power feeder and branch circuit wiring shall indicate the panel and circuit numbers. Boxes for communication and control wiring shall indicate the system or what the

wiring is for. The identification shall be written on the cover in bold characters using a wide tip, black permanent marker. Boxes for fire alarm system shall be painted "red." Boxes for video teleconferencing cabling shall be painted "hot pink."

- BB. Provide a pull box every 100 feet of conduit run and whenever an excessive number of bonds necessitates a pull box for ease of wire installation.
- CC. Junction boxes shall have only the holes necessary to accommodate the conduit at point of installation. All boxes shall have suitable provisions to secure covers.

### **3.02 INTERFACE WITH OTHER PRODUCTS**

- A. Coordinate installation of outlet box for equipment furnished under other Sections.
- B. Coordinate locations and sizes of required access doors.
- C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate mounting heights of outlet boxes with the device mounting heights indicated on the drawings.
- D. Coordinate mounting heights or outlet boxes with the device mounting heights indicated on the drawings.
- E. Orient boxes to accommodate wiring device orientation.
- F. Align adjacent wall mounted boxes for switches, thermostats and similar devices.
- G. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- H. Position outlet boxes to locate light fixtures as shown on reflected ceiling plan.
- I. Coordinate with structural and mechanical so that boxes will be accessible.
- J. Provide access panels for junction or pull boxes above inaccessible ceilings or in chases.

### **3.03 ADJUSTING**

- A. Adjust floor box flush with finish material.
- B. Adjust flush mounting outlets to make front flush with finished wall material.
- C. Install knockout closure in unused box opening.

### **3.04 CLEANING**

- A. Clean interior of boxes to remove dust, debris and other material.
- B. Clean exposed surfaces and restore finish where scratched or marred.

**END OF SECTION**

**SECTION 16140**  
**WIRING DEVICES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes wall switches, wall dimmers, receptacles, device plates and box covers, floor box service fittings, poke-through service fittings, and photocell switches.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.02 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.

**1.03 SUBMITTALS**

- A. Wall switches:
  - 1. Grade.
  - 2. Number of poles.
  - 3. Single, 3 or 4 way.
  - 4. Body and handle material.
  - 5. Color of handle.
  - 6. Voltage rating.
  - 7. Ampere rating.
  - 8. Dimensioned picture of the switch.
- B. Receptacles:
  - 1. Grade.
  - 2. Number of poles and wires.
  - 3. Grounding type.
  - 4. Material for body and face.
  - 5. NEMA configuration.
  - 6. Voltage rating.
  - 7. Amperage rating.

8. Dimensioned picture of the receptacle.
- C. Photocell Switches:
1. Light sensor type.
  2. Housing type.
  3. Temperature range.
  4. Time delay switch type.
  5. Number and ratings of contacts.
  6. Footcandle on/off ratings.
- D. Manufacturer's Installation Instructions: Indicate application condition and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the devices.

#### **1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100. Product shall bear the UL label.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

### **PART 2 PRODUCTS**

#### **2.01 WALL SWITCHES**

- A. Description: UL 20, Specification Grade, AC only general use snap switch; single or double pole, 3 or 4 ways as indicated.
- B. Body and Handle: Plastic with toggle handle. Handle black color.
- C. Ratings: 120-277 volts, AC, 20 amperes.

#### **2.02 DUPLEX RECEPTACLE**

- A. Description: UL 498, Specification Grade, 2 pole, 3 wire, grounding type duplex receptacle.
- B. Device Body: Plastic with nylon face, black color.
- C. Configuration: NEMA 5-20R.
- D. Ratings: 125 volts AC, 20 amperes.

#### **2.03 GROUND FAULT INTERRUPTER RECEPTACLES**

- A. Description: UL 943, Specification Grade, 2 pole, 3 wire, grounding type, duplex receptacle, 5 ma sensitivity, feed through type, test and reset buttons.
- B. Device Body: Plastic with plastic or nylon face, black color.



- C. Configuration: NEMA 5-20R.
- D. Ratings: 125 volts AC, 20 Amperes.

## **2.04 WALL PLATES**

- A. Interior Cover Plate: 302 polished finish stainless steel with beveled edges or raised stamped steel as indicated.
- B. Weatherproof Cover Plate: Gasketed cast aluminum with hinged gasketed self closing device cover designed to fit over a type FS outlet box. All springs, screw and other hardware shall be stainless steel. The plate shall be UL listed for wet locations with the cover closed.

## **2.05 PHOTOCELL SWITCHES**

- A. Description:
  - 1. UL 773A.
  - 2. Cadmium sulfide light sensor.
  - 3. Weatherproof diecast aluminum or polycarbonate housing with an Ultrasonic welded lexan or hermetically sealed glass sensor window, and threaded stem, nut and gasket.
  - 4. Temperature range: -30° F to +140° F.
  - 5. Bimetal time delay switch.
  - 6. Contacts shall be SPST snap action type rated for a minimum of 1800 watts for tungsten lads at 120 volts.
  - 7. Adjustable from approximately one to five candles "on" to approximately 3 to 15-foot candles "off."

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with NECA "Standard of Installation," NFPA 70 and manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- F. Install plates on switch, receptacle, and blank outlets in finished areas.
- G. Connect wiring devices by wrapping conductor around screw terminal.

- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and no surface mounted outlets.
- I. Install protective rings on flush cover service fittings.
- J. Arrangement of Devices: Mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.
- K. Protect devices and assemblies during painting.
- L. Install wall plates when painting is complete.

### **3.02 IDENTIFICATION**

- A. Comply with Section within specification section 16050 "Electrical Identification."

### **3.03 CONNECTIONS**

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A.

### **3.04 FIELD QUALITY CONTROL**

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

### **3.05 CLEANING**

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

**END OF SECTION**

## SECTION 16182

### CIRCUIT BREAKERS

#### PART 1 GENERAL

##### 1.01 SUMMARY OF WORK

- A. The work included under this Section consists of furnishing all materials and equipment and performing all labor and services necessary for the complete installation of the circuit breakers, including related systems and accessories as shown on the Drawings and hereinafter specified.

##### 1.02 QUALITY CONTROL

- A. Applicable Publications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Unless otherwise specified, the latest revision of the publication on the date of the invitation for bids shall apply.
  - 1. Underwriters Laboratories, Inc. (UL)
    - a. UL 489: Molded-case circuit breakers and circuit breaker enclosures.

#### PART 2 PRODUCTS

##### 2.01 CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: UL 489 9, of standard frame sizes, trip ratings, and number of poles, and with interrupting capacity to meet available fault currents.
  - 1. Frame Size Smaller than 250 Amperes: Thermal-magnetic type with inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
  - 2. Frame Size 250 Amperes and Larger: Electronic trip type, RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response (where specifically identified on the Drawings as required).
  - 3. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
  - 4. Application Listing: Appropriate for application; Type SWD for switching

fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

5. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup, time-delay and  $I^2t$  response settings, push-to-test feature, and ground-fault indicator (where specifically identified on the Drawings as required).

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of over current protective devices.
- B. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cables.
- C. Inspect circuit-breaker-operating mechanisms for malfunctioning and where necessary, adjust units for free mechanical movement.

**END OF SECTION**

## SECTION 16236

### EMERGENCY GENERATOR SYSTEMS

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. The Contractor shall furnish and install a new 300 KW, 480Y/277V standby generator at Master Lift Station Tara #20. The work shall include the furnishing of all labor, materials, equipment, and incidentals necessary for the installation of a complete and operable standby power generation facility as shown on the drawings and specified herein.

##### 1.2 RELATED WORK

- A. Section 03010 – Concrete Work
- B. Section 05500 – Miscellaneous Metals
- C. Division 16 – Electrical

##### 1.3 REFERENCE CODES & STANDARDS

- A. Codes and Standards: Conform to provisions of the following, except as otherwise indicated or specified:
  - 1) Underwriter's Laboratories, Inc. (UL)
    - a. 142 – Steel Aboveground Tank for Flammable and Combustible Liquids
    - b. 2085 – Protected Aboveground Tank for Flammable and Combustible Liquids
  - 2) American Society for Testing and Materials (ASTM)
  - 3) American National Standards Institute (ANSI)
  - 4) The Society for Protective Coatings (SSPC)
- B. The generator set shall conform to the requirements of the following codes and standards:
  - 1) CSA C22.2, No. 14 – M91 Industrial Control Equipment.
  - 2) EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
  - 3) EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

- 4) IEC8528 part 4. Control Systems for Generator Sets.
- 5) IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
- 6) IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
- 7) NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
- 8) NFPA99 – Essential Electrical Systems for Health Care Facilities.
- 9) NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
- 10) UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

#### **1.4 SUBMITTALS**

- A. In accordance with Section 01340, Shop Drawings, Project Data, and Samples, submit to the Engineer 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. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer. Submittals shall include the following:
  - 1) Certified shop and erection drawings and data.
  - 2) Prototype test certification.
  - 3) Literature on drawings describing the equipment and showing all-important details of construction and dimensions including, but not limited to:
    - a. Complete catalog information, descriptive literature, materials of construction, all standard and optional accessories to be supplied, and specifications on tanks, control panels, level switches and sensors, valves, vents, etc, and accessories.
    - b. Schematic wiring diagrams and interconnection diagrams identifying by terminal numbers.
- C. Operating Instructions: Operating and maintenance instructions for each fuel system component shall be furnished per Section 01730, Operating and Maintenance Data.
- D. Installation: The manufacturer shall provide installation instructions.

#### **1.5 SHOP DRAWINGS**

- A. Shop drawings as specified in Division 1, General Requirements, shall be submitted

for the following items of equipment:

- 1) Engine
- 2) Generator
- 3) Generator Controller
- 4) Batteries and Charger System
- 5) Jacket Water Heater
- 6) Exhaust System
- 7) Enclosure
- 8) Annunciator
- 9) Vibration Isolators
- 10) Exhaust Silencer
- 11) Fuel Storage Tank and Appurtenances

B. Contents of the shop drawings shall include the following:

- 1) Details of construction, setting, and anchorage of unit.
- 2) Dimensions.
- 3) Materials.
- 4) Material Thickness.
- 5) Finish.
- 6) Ratings.
- 7) Accessories.
- 8) Trim.
- 9) Fuel Schematic Diagram.

## **1.6 MANUFACTURER'S LITERATURE**

A. Manufacturer's literature shall be submitted for the equipment listed in paragraph 1.05, Shop Drawings, and shall include the following information:

- 1) Written description of equipment function, normal operating characteristics and limiting conditions.
- 2) Recommended assembly, installation, alignment, adjustment, and calibration instructions.
- 3) Description and recommended installation instructions for all items of equipment.
- 4) Operating instructions for start-up, normal operation, regulation, shutdown, and emergency conditions.

- 5) Maintenance instructions and timetables.
- 6) Guide to troubleshooting.
- 7) Parts list with identification to assembly drawing.
- 8) Outline and assembly drawings, engineering data and wiring diagrams.

#### **1.7 OPERATION AND MAINTENANCE MANUAL**

- A. Prior to final acceptance of this project, an operation and maintenance manual shall be submitted. The manual shall include manufacturer's literature, drawings corrected per shop drawing review comments, and lists of suppliers and/or service shops that can provide parts and accessories and equipment repair for the items of equipment listed under shop drawings above. These lists shall include a contact name, telephone number, and address.

#### **1.8 POSTED OPERATING INSTRUCTIONS**

- A. Operating instructions approved by the Engineer shall be provided for each principal piece of equipment for the use of operation and maintenance personnel. The operating instructions shall include wiring and control diagrams showing the schematic layout of the system. Operating instructions shall be printed or engraved and shall be framed under glass or in approved laminated plastic and posted where directed by the Owner.

#### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver packaged material in manufacturer's original, unopened containers bearing manufacturer's name, brand, and UL label.
- B. The Contractor shall provide suitable protection of materials and equipment from dust and moisture. The Contractor shall be responsible for the condition of materials and equipment until the acceptance of equipment by the Owner.
- C. Store material and equipment in a dry, clean location. Handle and store so as to avoid damage.

#### **1.10 WARRANTY**

- A. All equipment and materials supplied shall be warranted against defective design, materials and workmanship for a minimum period of 5 years or 2500 hours of operation which ever occurs first under normal use. Coverage shall include parts, labor and travel expenses. The warranty shall be comprehensive; there shall be no deductible warranty for the complete standby power system, including engine-generator, switchgear, automatic transfer switch and all supplied accessories. The warranty period shall begin when the generator is put into use and accepted by the Owner.



## **PART 2 PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. The generating set shall be mounted on a common structural steel, skid type base designed to maintain proper alignment of components. Suitable vibration isolators shall be furnished. The vibration isolators shall be securely attached to the mounting surface. The generator shall be set on an elevated pad of sufficient height above the surrounding floor or grade to allow the oil to be drained into a container supplied with generator.
- B. Generator enclosure shall include a single 208Y/120V load center therefore all generator appurtenances, including but not limited to the jacket water heaters and block heater, requiring power shall be rated for either 120V or 208V.

### **2.2 ENGINE**

- A. General
  - 1) The engine shall be a Caterpillar Model C9 300 kW, or equal approved by Manatee County.
  - 2) The engine shall be equipped with a heavy duty, dual, dry element air cleaner with restriction indicator.
  - 3) Engine protective systems shall be provided to cause engine shutdown on low lubricating oil pressure, high water temperature, overcrank, and overspeed. The fuel supply to the engine shall automatically close on a fault condition. Furthermore, an air inlet shut off shall be provided to assist engine shut off. Pilot lights shall be provided to visually indicate the cause of engine shutdown. Engine protective systems shall be provided with pre-alarm for pending engine shutdown, for low lubricating oil pressure and high water temperature.
  - 4) Engine shall be equipped with a governor to maintain frequency regulation within 3% (+/-1.8 hertz) from no load to full load. The frequency at any constant load, including no load, shall remain within a steady state bandwidth of 0.25% of rated frequency. Governor shall be a Caterpillar ADEM II electronic type or equal.
  - 5) The engine shall be equipped with a pressure lubrication system supplying a continuous flow of lubricant, under pressure, to all moving parts. Pistons shall be spray cooled. Circulation shall be by means of a positive displacement gear type pump. The lubrication system shall include full-flow filters and series connected oil cooler of sufficient size to properly cool all lubricating oil circulated. Filter systems shall be equipped with a spring-loaded bypass valve as an insurance against stoppage of lubricating oil circulation in event the filters become clogged.
  - 6) Cooling System

- a. The cooling system shall be a unit mounted radiator design and shall be engineered to function with a 50% ethylene glycol and 50% water solution. Cooling system shall be winterized for operation in temperature to -33.8°F (-36 C).
  - b. Jacket water heater(s) shall be installed having ample capacity to automatically maintain water temperature at 120°F (48.9°C) in a 30°F (-1.1°C) ambient. Heater operating voltage shall be 208 volts, single phase, 60 hertz. A resistance type heater shall be utilized. An amber indicating light shall be installed in the control panel to give indication that jacket water temperature is below 100F.
  - c. The cooler shall be capable of operating in a 122°F (50°C) ambient.
  - d. Each bank of cylinders shall have a minimum of one coolant drain port.
- 7) The generating set shall be equipped with a 24 -volt DC electric starting system. Heavy duty, lead acid storage batteries having sufficient capacity for cranking the engine for at least 4 minutes at firing speed in an ambient temperature of 40°F shall be provided, complete with battery rack and cables.
  - 8) Cranking period shall be controlled by a speed sensor, which disengages the starting motor when the engine has started. Battery charging alternator or generator voltage may not be used for this signal. The cranking period shall be limited to thirty seconds. At the end of the cranking period the starter shall disengage and the overcrank alarm shall be activated.
  - 9) A current limiting two-rate battery charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressors, DC voltmeter, DC ammeter and fused AC input. DC output shall be not less than 10 amperes and the unit shall be AC line compensated. Charger shall have contacts that operate upon a battery or charger malfunction to provide an alarm condition on the control panel.

### **2.3 GENERATOR-480 VOLT**

- A. The generator shall be four pole, brushless, of drip-proof construction with amortisseur windings. Insulation shall be Class H with fungus resistant epoxy varnish. Temperature rise shall be 80°C maximum at standby rating, and rise shall be determined by stator resistance. A rotating thyristor bridge module optically coupled to a firing circuit type voltage regulator shall control generator field current. The exciter shall be 4-pole permanent magnet type.
- B. The generator shall have two bearings. Bearings shall be insulated against shaft currents. Bearings shall be sleeve type, bracket mounted with contained oil lubrication serviceable without moving or disconnecting the alternator. Exciter end

- bearing shall be insulated to prevent circulating currents, while drive end bearing shall provide thrust capacity adequate for maintaining rotor and stator alignment.
- C. The generator shall be able to sustain a 300% rated current for 10 seconds during a short circuit condition. The generator shall be Permanent Magnet type to match existing units.
  - D. The generator shall be supplied with five cable terminations, consisting of three phases, neutral and ground. Number and size of lugs per cable termination shall be as required by drawings. Neutral shall be isolated from ground.
  - E. Radio-interference suppression meeting commercial standards shall be supplied.
  - F. The generator controls shall include a volts per hertz type automatic voltage regulator rated to provide less than  $\pm 0.5\%$  voltage deviation at steady state and less than  $\pm 1.0\%$  voltage deviation between no load and full load operation.
  - G. The generator shall be designed for 60 Hz operation.
  - H. Stator winding shall be wound with a 0.667 pitch factor.
  - I. Provide 6 RTD's in the center of the stator windings (two per phase - minimum length to be 6 inches) for temperature monitoring of the generator. Since the location is typically the hottest in the stator, set the alarm for approximately  $15^{\circ}\text{C}$  over the permitted temperature rise by resistance plus ambient.
  - J. Provide thermostatically controlled space heaters in the generator of sufficient wattage (as specified by the manufacturer) to adequately keep condensation out of the stator and rotor windings.
  - K. Provide a nameplate on the generator that shall have, as a minimum, the following: Rating in Prime and Standby kW, Power Factor, Frequency, Voltage, Insulation Class, Design Ambient Temperature, Full Load Rise by Resistance, Voltage and Wattage of Space Heaters, and Resistance Value of RTD's.
  - L. Provide a separate conduit box on the generator for control wiring. These devices shall not be installed in the same conduit box as the power supply cables.

## 2.4 GENERATOR CONTROLLER

- A. Standards:
  - 1) Control: The generator must meet NFPA-110 Level 1 requirements (1996 version) and must have an integral alarm horn as required by NFPA.
  - 2) NFPA-99 and NEC must also be accommodated.
  - 3) Set control must be listed under UL 508.
- B. Applicability:
  - 1) The control must be usable on 12- or 24-volt starting systems.
  - 2) Environment:

- a. -40°C to +70°C operating temperature range.
  - b. 5-95% humidity, noncondensing.
  - c. Mount the control on the generator. The control must be mounted for ease of viewing.
- C. Hardware Requirements:
- 1) The control shall have a run-off/reset-auto three-position selector switch. If required, in the plans and specs, a version of the control shall have a key operated selector switch.
  - 2) A controller mounted latch type emergency stop push button must be supplied.
  - 3) It shall be possible to adjust alternator output voltage at the control.
  - 4) Five Indicating Lights:
    - a. System Ready – Green.
    - b. Not In Auto – Yellow.
    - c. Programming Mode – Yellow.
    - d. System Warning – Yellow.
    - e. System Shutdown – Red.
  - 5) Lighted display with two lines of 20 alphanumeric characters for messages. Panel lights must be supplied as standard.
  - 6) Sixteen-position snap action sealed keypad for menu selection and data entry.
  - 7) For ease of use, an operating guide must be on the controller faceplate.
  - 8) An audible alarm must be supplied in the control.
- D. Control Functional Requirements:
- 1) Field programmable time delay for engine start. Adjustment range, 0-5 minutes in 1-second increments.
  - 2) Field programmable time delay engine cooldown. Adjustment range, 0-10 minutes in 1-second increments.
  - 3) It shall be possible to start the generator and run it at an idle speed during warm-up. The idle time must be user adjustable. Engine cooldown at idle must also be available. Required for ECM equipped engines only.
  - 4) Real time clock and calendar for time stamping of events.
  - 5) Output with adjustable timer for an ether injection starting system. Adjustment range, 0-10 seconds.
  - 6) Output for shedding of loads if the generator reaches a user programmable percentage of its kW rating. Load shed must also be enabled if the generator

output frequency falls below 59 Hz (60 Hz system) or 49 Hz (50 Hz system).

- 7) Programmable cyclic cranking that allows up to six crank cycles and up to 45 seconds of crank time per crank cycle.
- 8) The capability to reduce controller current battery draw, for applications where no continuous battery charging is available must be provided. The controller vacuum fluorescent display should automatically be turned off after 5 minutes of no controller activity.
- 9) The controller firmware must provide alternator protection for overload and short circuit matched to each individual alternator and duty cycle.
- 10) A  $\pm 0.25\%$  digital voltage regulator must be incorporated into the controller software. No separate voltage regulator is acceptable. The digital voltage regulator must be applicable on single or three phase systems.
- 11) It must be possible to exercise the generator by programming a running time into the controller. This feature must also be enabled through the PC software.

E. Generator System Monitoring Requirements:

- 1) All monitored functions must be viewable on the digital display.
- 2) The following generator functions must be monitored:
  - a. All output voltages - single phase, three phase, line to line, and line to neutral, 0.25% accuracy.
  - b. All single phase and three phase currents, 0.25% accuracy.
  - c. Output frequency, 0.25% accuracy.
  - d. Power factor by phase with leading/lagging indication.
  - e. Total instantaneous kilowatt loading and kilowatts per phase, 0.5% accuracy.
  - f. kVARS total and per phase, 0.5% accuracy.
  - g. kVA total and per phase, 0.5% accuracy.
  - h. kW hours.
  - i. A display of percent generator duty level - actual kW loading divided by the kW rating.
- 3) Engine parameters listed below shall be monitored:
  - a. Coolant temperature both in English and metric units.
  - b. Oil pressure in English and metric units.
  - c. Battery voltage.
  - d. Rpm.

- e. Lube oil temperature.
  - f. Lube oil level.
  - g. Crankcase pressure.
  - h. Coolant level.
  - i. Coolant pressure.
  - j. Fuel pressure.
  - k. Fuel temperature.
  - l. Fuel rate.
  - m. Fuel used during the last run.
  - n. Ambient temperature.
- 4) Operational records since system start up must be stored in the controller:
- a. Run time hours.
  - b. Run time loaded.
  - c. Run time unloaded.
  - d. Number of starts.
  - e. Factory test date.
  - f. Last run data including date, duration, and whether loaded or unloaded.
  - g. kW hours.
- 5) The following operational records must also be available in a resettable form for maintenance purposes:
- a. Run time hours.
  - b. Run time loaded.
  - c. Run time unloaded.
  - d. Kilowatt hours.
  - e. Days of operation.
  - f. Number of starts.
  - g. Start date after reset.
- 6) The controller must store the last one hundred generator system events with date and time of the event.
- 7) For maintenance and service purposes, the following information must be stored in the control and displayed on demand:
- a. Manufacturer's model and serial number.

- b. Battery voltage.
  - c. Generator set kilowatt rating.
  - d. Rated current.
  - e. System voltage.
  - f. System frequency.
  - g. Number of phases.
- F. The control must be capable of detecting the following conditions, indicate if the condition will shutdown the generator or provide a warning, and annunciate the situation, using words and phrases, on the digital display.
- 1) Will cause a system shutdown:
    - a. Air damper tripped (if used).
    - b. Customer programmed digital auxiliary input ON (any of the 21 inputs available).
    - c. Customer programmed analog auxiliary input out of bounds (any of 7 inputs for ECM equipped engines).
    - d. Emergency stop.
    - e. High coolant temperature.
    - f. High oil temperature.
    - g. Controller internal fault.
    - h. Locked rotor - fail to rotate.
    - i. Low coolant level.
    - j. Low oil pressure.
    - k. Master switch error.
    - l. NFPA common alarm.
    - m. Overcrank.
    - n. Overspeed with user adjustable level, range 65-70 Hz.
    - o. Generator overvoltage with user adjustable level, range 105% to 135%.
    - p. Overfrequency with user adjustable level, range 102% to 140%.
    - q. Underfrequency with user adjustable level, range 80% to 90%.
    - r. Generator undervoltage with user adjustable level, range 70% to 95%.
    - s. Coolant temperature signal loss.
    - t. Oil pressure gauge signal loss.

- 2) Will cause a warning but leave the generator running:
  - a. Battery charger failure.
  - b. Customer programmed digital auxiliary input on (any of the 21 inputs available).
  - c. Customer programmed analog auxiliary input on (any of the 7 inputs available on ECM engines).
  - d. Power system-supplying load.
  - e. Ground fault detected - detection by others.
  - f. High battery voltage - Level must be user adjustable.
  - g. Range 29-33 volts for 24-volt systems.
  - h. High coolant temperature.
  - i. Load shed.
  - j. Loss of AC sensing.
  - k. Underfrequency.
  - l. Low battery voltage – level must be user adjustable, Range 20-25 volts for 24-volt systems.
  - m. Low coolant temperature.
  - n. Low fuel level or pressure.
  - o. Low oil pressure.
  - p. NFPA common alarms
  - q. Overcurrent.
  - r. Speed sensor fault.
  - s. Weak battery.
  - t. Alternator protection activated.

G. Inputs and Outputs:

1) Inputs:

- a. There shall be 21 dry contact inputs that can be user configured to shutdown the generator or provide a warning.
- b. There shall be 7 user programmable analog inputs for monitoring and control.
- c. Each analog input can accept 0-5 volt analog signals.
- d. Resolution must be 1 part in 10,000.
- e. Each input can be programmed to provide up to 4 trip values – 2



warnings and 2 shutdowns.

- f. It must be possible to view the analog value on the display.
- g. It shall be possible to define each user-configured input using words or phrases that will be viewable on the digital display.
- h. Additional standard inputs required:
  - (1) Input for an external ground fault detector. Digital display must show "ground fault" upon detection of a ground fault.
  - (2) Reset of system faults.
  - (3) Remote two wire start.
  - (4) Remote emergency stop.
- i. Idle mode enable.

2) Outputs:

- a. All NFPA 110 Level 1 outputs must be available. Output specified on the drawings shall be hardwired to an existing plant control system for monitoring of the generator by that control system.
- b. There shall be thirty outputs available for interfacing to other equipment:
  - (1) Any of these outputs shall be able to be user configured from a list of over 25 functions and faults.
  - (2) These outputs shall drive optional dry contacts.
- c. A programmable user defined common fault output with over 40 selections shall be available.

H. System Programming:

- 1) It must be possible to disable programming so the system can only be monitored.
- 2) It shall be possible to program the control with the controller keypad or using an IBM compatible personal computer.
- 3) Programming access is to be enabled only at the controller and must be password protected.
- 4) The following must be programmable from the controller keypad:
  - a. Time Delay Settings:

- (1) Generator run time (0 to 72 hours) – exercise.
- (2) Load shed.
- (3) Engine start.
- (4) Engine cooldown.
- (5) Overvoltage and undervoltage delays.
- (6) Starting aid.
- (7) Crank on and crank pause time.
- (8) Idle time.

b. Trip Point Settings:

- (1) High battery voltage.
- (2) Low battery voltage.
- (3) Overspeed.
- (4) Underfrequency.
- (5) Overfrequency.
- (6) Overvoltage.
- (7) Undervoltage.
- (8) Load shed.

I. Communications:

- 1) The generator engine ECM (engine control module) must communicate to the ECM for control, monitoring, and diagnostics. SAE J1939 standard communications is required.
- 2) Industry standard Modbus RTU communication shall be available.
- 3) A Modbus master will be able to monitor controller data.
- 4) A Modbus master will be able to alter parameters.
- 5) The Modbus master must be capable of starting and stopping the generator.

J. Communications & Personal Computer Software:

- 1) The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows software.
- 2) Both RS-232 and RS-485 communication formats shall be available.
- 3) A variety of connections shall be available based on requirements:
  - a. A single connection to a PC. A cable length of up to 4000 feet must be supported.
  - b. Multiple devices at a single location connected to a PC.
  - c. A single connection from a device to a PC over phone lines.
  - d. Multiple devices to a PC over phone lines.
- 4) When equipped with communications modules, transfer switches and power monitors along with generator controllers must be able to be connected to the same communication network with no additional interfaces being required.
- 5) The capability to connect up to 128 devices (generator set controls and transfer switches) on a single network must be supported.
- 6) Cabling is to be device to device in a daisy chain fashion with no limitation on device locations within the network.
- 7) The network must be self- powered. No power wiring between devices is allowed.
- 8) A single software package with the following capabilities is required:
  - a. Any combination of transfer switches and generator controls.
  - b. Up to 128 devices at a single site must be supported.
  - c. The same software package must support communications over phone lines. The software shall allow communications with up to 128 sites (phone numbers) including phone number fields large enough for International communication.
  - d. Access to individual devices by the software shall be protected by password.
  - e. To support future expansion, it must be possible to add devices (ATS and generator set controllers), up to 128 and sites up to 128, with the installed software. Changing to a different software package is not acceptable.
  - f. All displays, data inquires, and program functions allowed on the controllers, both generator and ATS, shall also be available through the software.
  - g. A single software screen must be capable of displaying data from multiple devices simultaneously.

- h. It shall be possible to reset shutdown faults, and restart the generator using the software.
- i. If a transfer switch is used, it must be possible to start the generator and transfer the loads to the generator.

## 2.5 GENERATOR ACCESSORIES

- A. Line circuit breaker sized as shown on the drawings, molded case type, generator mounted with 24 VDC shunt trip wired to the engine/generator safety shutdowns located adjacent to existing pump station utility service entrance breaker.
- B. Engine Block Heater: Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.
- C. Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.
- D. 12-volt lead-acid battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0°F, per SAE Standard J-537, shall be supplied.
- E. 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.
- F. Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connection.
- G. Two flexible fuel lines rated 300°F and 100 psi ending in pipe thread.
- H. A dry contact kit containing a single relay.
- I. Remote annunciator panel enabling the generator status to be viewed remotely. This remote annunciator panel shall include a fourteen (14) relay dry contact box for connection to the controller terminal strip. The panel shall have the capability to be either flush mounted or surface mounted.
- J. Run Relay to provide a three-pole, double-throw relay with 10 amps at 250 VAC contacts for indicating that the generator is running.
- K. Common Failure relay to remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and overspeed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
- L. Generator prealarm senders.
- M. Remote emergency stop breakglass switch in a NEMA 3R enclosure.
- N. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the

engine as part of the generator package such that the fuel filter/water separator will be inside the generator enclosure. Provide isolation valves for the fuel filter/water separator as recommended by the manufacturer.

## **2.6 GENERATOR ENCLOSURE**

- A. The complete diesel engine generator set, including generator control panel, engine starting batteries, rear mounted breaker, and exhaust silencer, shall be enclosed in a factory assembled, sound attenuated enclosure mounted on a concrete slab.
- B. The enclosure shall be weather resistant and sound attenuated constructed of 14 gauge steel with electrostatically applied powder coated baked polyester paint. Fasteners shall be either zinc plated or stainless steel.
- C. Enclosure shall include lockable access doors. Double doors on both sides shall be vertically hinged to allow 180 degree opening rotation. A door with an integral panel viewing window shall be provided for access to the control panel and breaker.
- D. Enclosure shall include lube oil and coolant drain pipes to exterior, terminating with drain valves. A radiator fill cover shall be provided. The roof mounted silencer exhaust shall include a rain cap.
- E. Enclosure shall include an externally mounted emergency stop button..
- F. The enclosure shall have a resulting sound level of 83.3dba @ 3.3ft and with the genset running under full load. The sound level shall also adhere to all governmental codes having jurisdiction of the area where installed. It shall consist of a roof, side walls, and end walls. Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.

## **2.7 EXHAUST SYSTEM**

- A. A super critical grade silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. The silencer shall be internally mounted within the generator enclosure and provided by the generator/enclosure manufacturer to ensure a proper fit. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer

## **2.8 ABOVE GROUND FUEL STORAGE TANK**

- A. The above ground storage tank shall be a UL 2085 listed and labeled, secondarily contained and protected, concrete-vaulted, double-walled rectangular steel tank, Envirovault Model EV-1500 as manufactured by Phoenix Products in Jacksonville, FL (904-354-1858) or equal. The tank nameplate capacity shall be 1,500 gallons.
- B. The tank shall be constructed in accordance with UL 142. The primary tank shall be fabricated from 1/4" steel minimum thickness and tested at 3 psi air pressure. The

- inner tank shall be fabricated of 3/16" steel minimum thickness and shall be tested at 1.5 psi air pressure.
- C. Tank shall have a thirty (30) year warranty that includes the concrete vaulting materials, the primary tank, and the secondary tank. The tank coating system shall be warranted for five (5) years.
  - D. The annular space between the inner and outer walls shall be filled with a minimum of six inches of lightweight concrete, to provide a minimum two hour fire wall rating per the Uniform Building Code and UL.
  - E. The tank shall include earthquake/hurricane restraint tie-downs with neoprene pads between the tank feet and concrete pad. The tank shall be elevated off the concrete pad with integral tank supports that provide a 2 inch air space to control moisture accumulation.
  - F. Outer tank shall be sandblasted per SSPC-SP10 (White Metal Blast), and then painted with one coat of high-build polyester glass flake (International Glassflake), minimum 12 to 15 mils (DFT) thickness, and a finish coat of Aliphatic Polyurethane, 3 to 5 mils (DFT) thickness.
  - G. All tank outlets shall be 304 Schedule 40 stainless steel threaded pipe.
  - H. All tanks shall be labeled by product, capacity, and manufacturer.
  - I. Updraft and emergency venting shall be provided by tank manufacturer per UL 2085 requirements.
  - J. Tank shall be equipped with the following options installed at the factory prior to shipment:
    - 1. Grade fill box to permit filling the tank from ground level, with integral spill containment with spring loaded UL listed drain, 3 inch tight fill adapter with angle check valve, ball valve, and weatherproof stainless steel construction.
    - 2. Mechanical fill limiter set to shut off at 95% tank capacity.
    - 3. Three-inch updraft vent with riser assembly for primary venting and two 6-inch emergency vents.
    - 4. Mechanical level gauge visible at grade fill location.
    - 5. Leak sensor in the interstitial space, Veeder Root Interstitial Sensor for Steel Tanks, model 794390, tied to the Tank Inventory System.
    - 6. Level measurement by a Veeder Root Magenetostrictive Plus Probe, model 846391, tied to the Tank Inventory System.
    - 7. Fuel Oil Supply. Provide one 1" FOS connection with drop tube, 1" double poppet brass foot valve and a 1½" anti-siphon valve.
    - 8. Fuel Oil Return. Provide one 1" FOR connection.
    - 9. The Tank Inventory System shall be a Veeder Root Model TLS300C, to match the County's existing installations. The system shall monitor fuel

quantity in the tank, amount of utilage, and leakage in the interstitial space. Warnings and alarms shall be activated for leak, overfill, low product, high product, sudden loss, and delivery needed. The system shall include an integral printer and output alarms for leak detection and low level at 25% for fuel replenishing to the control cabinet in the new Electrical Building. The probes shall be mounted on the tank prior to shipping.

## **2.9 FUEL PIPING & VALVES**

- A. The fuel piping shall be black steel pipe, ASTM A53, Schedule 40.
- B. Fittings shall be 2000# forged steel manufactured in accordance with ASTM A105, Grade II and dimensionally conforming to ANSI B16.11.
- C. Joints shall be threaded. Threads shall be full, clean, sharp and true conforming to ANSI B1.20.1. Use approved Teflon tape or pipe joint compound which is resistant to the effects of diesel fuel. Apply to male threads only.
- D. Unions shall be provided per applicable codes and as shown on the Drawings.
- E. After installation, the piping shall be pressure tested per the latest requirements of NFPA 31.
- F. Fuel piping valves shall be manufactured to NFPA 31 standards for diesel fuel piping applications and shall be of brass construction with fuel resistant gaskets and seals.
- G. Provide shut-off valve on fuel supply line just prior to the line entering between the generator rails, such that the location is accessible, but not directly in the walkway. Fuel supply shut-off valve shall be labeled as such.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install tanks, pumps, piping, accessories, and control equipment in accordance with approved shop drawings and installation instructions from the manufacturers. Read and heed all warning tags and labels.
- B. Conflicts between the manufacturer's requirements and recommendations and these Specifications or the Drawings shall be presented to the Engineer for resolution before any affected work is started. Installed equipment shall be certified as appropriate for the application and process by the Contractor.

### **3.2 FIELD ACCEPTANCE TESTS**

- A. Upon completion of installation, a full operating test shall be performed in the presence of the Engineer and a qualified manufacturer's representative to demonstrate its ability to operate appropriately.
- B. The manufacturer's service representative shall review recommended operation and maintenance procedures with the Owner's personnel.

- C. Verify proper sequence and operation of all associated process control and monitoring components.
- D. Make all final adjustments necessary to place equipment in satisfactory working order at time of above tests.
- E. Correct all defects or defective equipment or replace promptly at no expense to the Owner.

### **3.3 GENERATOR TESTING**

- A. Contractor shall retain the services of the generator manufacturer's representative to perform the following testing once the generator has been installed.
- B. Site Tests: An installation check, start-up, and 4-hour full load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
  - 1) Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
  - 2) Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, remote annunciator, etc.
  - 3) Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.
  - 4) Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate KW rating.
  - 5) Heat Run Test : measure the temperature rise by resistance under full load test in accordance with IEEE standards.

**END OF SECTION**



## SECTION 16269

### VARIABLE FREQUENCY CONTROLLERS

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

- A. This specification describes an AC variable speed/torque Drive used to control the speed/torque of a NEMA design B induction motor. The drive must also provide an optional operational mode for scalar or V/Hz operation.
- B. The Drive shall be manufactured by a firm with at least ten (10) years experience in the production of this type of equipment. Per county requirements, the drive shall be ABB ACS800 series.

##### 1.02 QUALITY ASSURANCE

- A. The Drive manufacturing facility shall be ISO 9001 and 14001 certified.
- B. The Drive shall be UL listed, or Canadian UL listed, or CSA listed and comply with EMC Directive 89/336 EEC, Low Voltage Directive 73/23 EEC and Machinery Directive 98/37 EC in accordance with the European Union's CE directive.
- C. All printed circuit boards shall be completely tested and burned-in before being assembled into the completed Drive. The Drive shall then be subjected to a preliminary functional test, minimum one (1) hour burn-in and computerized final test. The burn-in shall be at 104°F (40°C), at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation.
- D. The Drive shall utilize efficient IGBT technology throughout the entire Drive manufacturer's Power and Voltage range.
- E. The Drive shall utilize the same communications architecture, utilizing plug-in communications cards, for high-speed noise immune connectivity throughout the entire Drive manufacturer's Power range.
- F. The Drive manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray components, and decap or delaminate components and analyze failures within the component.
- G. The Drive shall utilize surface mount technology in the manufacturing of internal printed circuit boards and electronics, for maximum performance and reliability.

### 1.03 SUBMITTALS

- A. The Submittals shall include the following information:
1. Outline Dimensions.
  2. Weight.
  3. Compliance to IEEE 519 - Harmonic analysis for particular jobsite including total voltage harmonic distortion and total current distortion.
    - a. The Drive manufacturer shall provide calculations, specific to this installation, showing total harmonic current distortion (TDD), at the Point of Common Coupling (PCC), is less than required. Input line filters shall be sized and provided as required by the Drive manufacturer to ensure compliance with IEEE standard 519-1992, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems. The acceptance of this calculation must be completed prior to Drive installation.
    - b. Prior to installation, the Drive manufacturer shall provide the estimated total harmonic distortion (THD) caused by the Drive. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.
    - c. If the total harmonic current distortion (TDD), at the Point of Common Coupling (PCC), exceeds required levels, the Drive manufacturer is to recommend the additional equipment required to reduce the current TDD to an acceptable level.

## PART 2 PRODUCTS

### 2.01 ADJUSTABLE FREQUENCY DRIVES (AFD)

- A. The Drive shall be solid state, with a Pulse Width Modulated (PWM) output. The drive shall be a Direct Torque Control (DTC) AC to AC converter utilizing the latest isolated gate bipolar transistor (IGBT) technology. The Drive shall employ Direct Torque Control (DTC) inner loop torque control strategy that mathematically determines motor torque and flux every 25 microseconds ( $\mu$ s) (40,000 times per second). The drive must also provide an optional operational mode for scalar or V/Hz operation.
- B. Ratings:
1. The Drive shall be rated to operate from 3-phase power at 230VAC to 500VAC +10/-10%, 48Hz to 63Hz. The Drive shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.97 at all speeds and loads. The Drive efficiency shall be 98% or better at full speed and load. An internally mounted AC line reactor or DC choke shall be provided to

reduce input current harmonic content, provide protection from power line transients such as utility power factor correction capacitor switching transients and reduce RFI emissions.

2. The overvoltage trip level shall be a minimum of 30% over nominal, and the undervoltage trip level shall be a minimum 35% under the nominal voltage.
3. Output voltage and current ratings shall match the adjustable frequency operating requirements of standard 460VAC, 3ph, 60Hz, NEMA design A or NEMA design B motors. The overload current capacity shall be 110% of rated current for one (1) minute out of five (5). Output frequency shall be adjustable between 0Hz and 300Hz. Operation above motor nameplate shall require programming changes to prevent inadvertent high-speed operation. The drive's switching pattern shall be continually adjusted to provide optimum motor flux and avoid the high-pitched audible noise produced by motors energized by conventional PWM drives. The drive shall be furnished in a UL Type 1 listed enclosure rated for operation at ambient temperatures between 0° and 40°C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed. The drive shall be protected from atmospheric contamination by chemical gasses and solid particles per IEC 721-3-3, classes 3C2 and 3S2. The drive shall be protected from vibration per IEC 68-2-6 (max. sinusoidal displacement 1 mm, 5Hz to 13.2Hz and max. acceleration  $7\text{m/s}^2$ , 13.2Hz to 100Hz).

C. Control Functions and Adjustments:

1. An intelligent start-up assistant shall be provided as standard. The Start-up assistant will guide the user through all necessary adjustments to optimize operation and will include "plug and produce" operation, which recognizes the addition of options/fieldbus adapters and provides the necessary adjustment assistance.
2. Start-up data entries shall include motor nameplate power, speed, voltage, frequency and current.
3. A motor parameter ID function shall automatically define the motor equivalent circuit used by the sensorless vector torque controller.
4. A PID speed/torque loop regulator shall be provided with an autotune function as well as manual adjustments.
5. A selection of six (6) preprogrammed application macro parameter sets shall be provided to minimize the number of different parameters to be set during start-up. Macros included as standard are as follows: Factory Default, Hand/Auto, PID Control, Sequential Control, and Torque Control. A selection of two (2) user defined macros shall also be available.
6. Start/Stop control functions shall include two (2) or three-(3) wire

- start/stop, coast/ramp stop selections, optional dynamic braking and flux braking.
7. The AFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to reference without safety tripping or component damage (flying start). The AFD shall also be capable of flux braking at start to stop a reverse spinning motor prior to ramp.
  8. The AFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
  9. Accel/Decel control functions shall include two (2) sets of ramp time adjustments with linear and three (3) s-curve ramp selections.
  10. Speed/Torque control functions shall include:
    - a. Adjustable min. /max. speed and/or torque limits
    - b. Selection of up to 15 preset speed settings or external speed control
    - c. Three (3) sets of critical speed lockout adjustments.
    - d. A built-in PID controller to control a process variable such as pressure, flow or fluid level.
    - e. Reference signal processing shall include increase/decrease floating point control and control of both speed/torque and direction using a "joystick" reference signal. Two (2) analog inputs shall be programmable to form a reference by addition, subtraction, multiplication, minimum selection or maximum selection.
  11. Output control functions shall include:
    - a. Flux optimization to limit the audible noise produced by the motor and to maximize efficiency by providing the optimum magnetic flux for any given speed/torque operating point.
    - b. Current and torque limit adjustments to limit the maximum Drive output current and the maximum torque produced by the motor. These limits shall govern the inner loop torque regulator to provide tight conformance with the limits with minimum overshoot.
    - c. A torque regulated operating mode with adjustable torque ramp up/down and speed/torque limits.
  12. The Drive shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

13. The Drive shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.
  14. Two (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.
- D. Static and Dynamic Performance:
1. Open loop static speed regulation shall be 0.1% to 0.3% (10% of motor slip). When motor speed feedback is provided from a suitable encoder, closed loop speed regulation shall be 0.01% or better. Dynamic speed accuracy shall be 0.3-0.4 %-sec or better open loop and 0.1-0.2 %-sec or better-closed loop.
  2. Torque response time shall be 5ms or less. In the torque regulating mode, torque regulating accuracy shall be 4% or better.
- E. Operator Control Panel (Keypad):
1. Each Drive shall be equipped with a front mounted operator control panel (keypad) consisting of a four- (4-) line by 20-character back-lit alphanumeric display and a keypad with keys for Run/Stop, Local/Remote, Increase/Decrease, reset, menu navigation and parameter select/save.
  2. All parameter names, fault messages, warnings and other information shall be displayed in complete English words or standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.
  3. Other languages selectable in addition to American English (Am) shall be as follows: English (European), French, Spanish, Portuguese, German, Italian, Dutch, Danish, Swedish, Finnish, Czech and Polish.
  4. The Display shall have contrast adjustment provisions to optimize viewing at any angle.
  5. The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same drive or to another drive.
  6. All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.
  7. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus.
  8. The keypad shall be removable and insertable under drive power, capable of remote mounting, and shall have its own non-volatile memory.
  9. During normal operation, one (1) line of the control panel shall display the speed reference, and run/stop forward/reverse and local/remote status.

The remaining three (3) lines of the display shall be programmable to display the values of any three (3) operating parameters. At least 26 selections shall be available including the following:

- a. Speed/torque in percent (%), RPM or user-scaled units.
- b. Output frequency, voltage, current and torque.
- c. Input voltage, power and kilowatt hours.
- d. Heatsink temperature and DC bus voltage.
- e. Status of discrete inputs and outputs.
- f. Values of analog input and output signals.
- g. Values of PID controller reference, feedback and error signals.

F. I/O Capabilities:

1. Six (6) discrete inputs, all independently programmable with at least 25 input function selections. Inputs shall be designed for “dry contact” inputs used with either an internal or external 24 VDC source.
2. Three (3) form C relay contact outputs, all independently programmable with at least 30 output function selections. Relay contacts shall be rated to switch 2 Amps at 24VDC or 115/230VAC. Function selections shall include indications that the drive is ready, running, reversed and at set speed/torque. General and specific warning and fault indications shall be available. Adjustable supervision limit indications shall be available to indicate programmed values of operating speed, speed reference, current, torque and PID feedback.
3. Three (3) analog inputs, one (1) +/- 0VAC - 10VAC and two (2) 4mA - 20mA, all independently programmable with at least ten (10) input function selections. A differential input isolation amplifier shall be provided for each input. Analog input signal processing functions shall include: scaling adjustments, adjustable filtering and signal inversion. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of the following: (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus.
4. Two (2) analog outputs providing 4mA to 20mA signals. Outputs shall be independently programmable to provide signals proportional to at least 12 output function selections including output speed, frequency, voltage, current and power.

G. Serial Communications:

1. Serial communication interface modules are available for a wide selection

- of communication protocols. Available adapters are as follows: Modbus, Modbus Plus, Profibus DeviceNet, Interbus S, CANopen, ControlNet, LonWorks and CS 31. Communications modules shall be connected to the drive by fiber optic cables. I/O shall be accessible through the serial communications adapter.
2. Serial communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the Distributed Drive Controller (DDC) to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information. Additionally, remote Local Area Network (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored. The DDC system shall be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications.
  3. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for Digital Output DO (relay) control and Analog Output (AO) control. This control shall be independent of any AFD function. Examples of possible DO usage are as follows:
    - a. Opening check valves, opening discharge valves, starting auxiliary equipment, etc. In addition, the status of the DO's is available over the communications link. Examples of possible AO usage are as follows: Controlling a bypass valve position, throttling valve position, etc. In addition, the status of the AO's is available over the communications link.
  4. The AFD shall have built-in to its logic fifteen (15) blocks of adaptive programming capable of twenty (20) different functions. These blocks shall be connectable to drive actual signals and functions allowing the user to tailor the drive to the specific application requirements without additional hardware. These blocks shall be programmable through the standard operator panel and through the use of a DriveAP Microsoft Windows®-based software.
- H. A fiber optic communication port shall also be provided for personal computer interface. Microsoft Windows®-based software shall be available for drive setup, diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of drive performance.
- I. Protective Functions:
1. For each programmed warning and fault protection function, the drive shall display a message in complete English words or Standard English abbreviations. The five (5) most recent fault messages and times shall be

stored in the drive's fault history.

2. The drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.
3. Output short circuit and ground fault protection rated for 65,000 amps shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.
4. The drive shall provide electronic motor overload protection qualified per UL508C.
5. Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated voltage or undervoltage at 65% of min. rated voltage and input phase loss.
6. A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
7. Stall protection shall be programmable to provide a warning or stop the drive after the motor has operated above a programmed torque level for a programmed time limit.
8. Underload protection shall be programmable to provide a warning or stop the drive after the motor has operated below a selected underload curve for a programmed time limit.
9. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.
10. Input terminals shall be provided for connecting a motor thermistor (PTC type) to the drive's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact (klixon).

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. The Drive manufacturer shall provide adequate drawings and instruction material to facilitate installation of the Drive by electrical and mechanical tradespeople employed by others.

#### **3.02 START-UP**

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.
- B. The Drive manufacturer representative shall provide a minimum of two hour on-site training to county personnel. Training shall include operational and maintenance instructions specific to the installed equipment.



- C. The factory will extend the normal warranty for the Drive with a certified factory start-up.

**3.03 PRODUCT SUPPORT**

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the Drive products offered shall be locally available at both the specifying and installation locations.

**3.04 WARRANTY**

- A. Standard Warranty shall be 12 months from the date of start-up, not to exceed 18 months from the date of shipment. The warranty shall include all parts.
- B. With a certified start-up, warranty shall be 24 months from the date of start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time, and expenses.

**PART 4 OPTIONAL FEATURES**

- 4.01** Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed and/or CSA listed by the drive manufacturer as a complete assembly.

**END OF SECTION**

## SECTION 16410

### ENCLOSED SWITCHES AND CIRCUIT BREAKERS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
  - 1. Service disconnecting means.
  - 2. Feeder and branch-circuit protection.
  - 3. Motor and equipment disconnecting means.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- C. Related Sections include the following:
  - 1. Division 16 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
  - 2. Division 16 Section "Fuses" for fusible devices.

##### 1.02 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

##### 1.03 SUBMITTALS

- A. Data Sheets: Submit as a minimum the following information on each different disconnect switch. The information shall be in the form of the manufacturer's standard data sheets.
  - 1. Voltage rating.
  - 2. Ampere rating.
  - 3. Horsepower rating.
  - 4. Number of poles.
  - 5. Switch and contact materials.
  - 6. Fuseclips.
  - 7. Fuse type and ratings.

8. Handle; interlock and padlocking provisions.
  9. Enclosure type.
  10. Enclosure materials and finish.
  11. Dimensioned picture or drawing of the switch.
- B. Manufacturer's Instructions: Indicate application conditions and limitations for use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the switch.

#### **1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100. Products shall bear the UL label.
- B. Comply with NEMA AB 1 and NEMA KS 1.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### **1.05 COORDINATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### **PART 2 PRODUCTS**

#### **2.01 ENCLOSED SWITCHES**

- A. Fusible Switch Assemblies: NEMA KS 1, 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with high conductivity copper current carrying parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch ON position. Handle lockable in OFF position with two padlock provisions. Fuse clips: Positive pressure reinforced designed to accommodate Class R fuses.
- B. Nonfusible Switch Assemblies: NEMA KS 1, 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with conductivity copper current carrying parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position with two padlock provisions.
- C. Ratings: The number of poles, switch ampere rating (Minimum size is 30A/3P) and fuse ampere rating shall be as indicated.

- D. Fuses: UL Class RK1 unless otherwise indicated.
- E. Enclosures: Surface mounted, code gauge steel with manufacturer's standard gray enamel finish.
  - 1. Interior Dry Locations: NEMA Type 1.
  - 2. Exterior Locations: NEMA Type 3R.

## 2.02 ENCLOSED CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 5. Molded-Case Switch: Molded-case circuit breaker without trip units.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Compression style suitable for number, size, trip ratings, and material of conductors.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

## 2.03 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Outdoor Locations: NEMA 250, Type 4X, 316 stainless steel.
  - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

## **2.04 FACTORY FINISHES**

- A. Specify field-painting requirements in Division 9 Sections. Verify compatibility of factory finishes with field-applied coats.
- B. Manufacturer's standard prime-coat finish ready for field painting.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

### **3.03 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Enclosure Nameplates: Identify each disconnect switch by attaching a laminated plastic nameplate cover to the drive which is clearly and permanently lettered with the description and location of the equipment controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with ¼-inch minimum high white characters.

### **3.04 CONNECTIONS**

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main grounding bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.05 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed switch, circuit breaker,

component, and control circuit.

2. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### **3.06 ADJUSTING**

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### **3.07 CLEANING**

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

**END OF SECTION**

## SECTION 16415

### TRANSFER SWITCH

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. The requirements of the Contract, Division 16, applies to work in this section. Transfer switch as specified and shown on the Contract drawings shall be furnished and installed by the electrical contractor.

##### 1.02 SUBMITTALS

- A. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set and the transfer switch if it is included elsewhere in these specifications.

##### 1.03 TESTING

- A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
  - 1. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.

##### 1.04 PRODUCTION TESTS

- A. Final Production Tests: Each transfer switch shall be tested under load with all guards in place. Tests shall include:
  - 1. The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.
  - 2. The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.
  - 3. The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI C37.90a-2978 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

- B. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

#### **1.05 SITE TESTS**

- A. Site Tests: The manufacturer's local representative shall perform an installation check, start-up, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.

#### **1.06 WARRANTY & MAINTENANCE**

- A. A five-year basic extended warranty for the automatic transfer switch shall be included to guaranteed against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.
- B. The automatic transfer switch manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

#### **1.07 COMPLIANCE WITH CODES AND STANDARDS**

- A. The ATS shall conform to the requirements of:
  - 1. UL 1008--Standard for Automatic Transfer Switches.
  - 2. NFPA 70--National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700.
  - 3. NFPA 99--Essential Electrical Systems for Health Care Facilities.
  - 4. NFPA 110--Standard for Emergency and Standby Power Systems.
  - 5. IEEE Standard 446--Recommended Practice for Emergency and Standby Power Systems (Orange Book).
  - 6. IEEE Standard 241--Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book).
  - 7. NEMA Standard IC10 (formerly ICS 2-447) Automatic Transfer Switches.
  - 8. UL 508 – Standard for industrial Control Equipment.
  - 9. EN61000-4-5 Surge Immunity Class 4 (voltage sensing and programmable inputs only).
  - 10. EN61000-4-4 Fast Transient Immunity Severity Level 4.
  - 11. IEC Specifications for EMI/EMC Immunity as follows:
    - a. CISPR 1 Radiated Emissions.



- b. IEC 1000-4-2, Electrostatic Discharge.
- c. IEC 1000-4-3, Radiated Electromagnetic Fields.
- d. IEC 1000-4-4, Electrical Fast Transient (Bursts).
- e. IEC 1000-4-5, Surge Voltage.
- f. IEC 1000-4-6, Conducted RF Disturbances.
- g. IEC 1000-4-8, Magnetic Fields.
- h. IEC 1000-4-11, Voltage Variations and Interruptions

## 1.08 ELECTRICAL REQUIREMENTS

- A. Automatic transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.
- B. The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. Switches rated above 400 amperes shall be suitable for 30% tungsten-filament load.
- C. The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans.

## PART 2 PRODUCTS

### 2.01 EQUIPMENT

- A. The automatic transfer switch shall be ASCO 4000 Series or approved equal.
- B. The transfer switch shall have the following characteristics:
  - 1. 1200 amp current rating.
  - 2. 4 Pole.
  - 3. 4 wire, 3 phase.
  - 4. 480 Volt-60Hz.
  - 5. Solid Neutral.
  - 6. The withstand and closing ratings with a current-limiting fuse shall be 50,000 Amps.
  - 7. The withstand and closing ratings with any overcurrent protective device shall be 100,000 Amps.
- C. The ATS shall be furnished in a NEMA 1 enclosure.
- D. The switch shall be a 600-volt class.

## **2.02 MECHANICAL REQUIREMENTS**

- A. All main contacts shall be of silver composition. The main contacts shall be protected by arcing contacts in sizes 400 amperes and above. The main contacts shall be of the blow-on configuration and of segmented construction in ratings 600 amperes and above.
- B. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- C. The contact transfer time shall not exceed one-sixth of a second.
- D. All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.
- E. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- F. The neutral conductor shall be solidly connected as shown on the plans, a neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

## **2.03 TRANSFER SWITCH CONTROL SYSTEM**

- A. The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.
- B. The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.
- C. The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed:
  - 1. Keypad Pushbuttons:
    - a. Start/end system test.
    - b. Set/end exercise.
    - c. End time delay.
    - d. Lamp test/service reset.
  - 2. Light-Emitting Diode Status Indicators:

- a. Contactor Position: Normal, Off, Emergency.
  - b. Source Available: Normal, Emergency.
  - c. Service required: immediate, maintenance.
  - d. Not in automatic mode.
  - e. Four stage time delay remaining.
  - f. Exercise: load, no load, set/disabled.
  - g. Test: load, no load.
  - h. Load control active: peak shave, load shed, pre/post-transfer signal.
  - i. In-phase monitor active.
3. Outputs:
- a. Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.
  - b. Pre-transfer load control, one normally open contact rated 10 amps @ 30 VDC/250 VAC.
  - c. One Programmable output, factory-set to load bank control rated 2 amps @ 30 VDC/250 VAC.

## 2.04 OPERATION

- A. All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over- and under-frequency. In addition, the controller shall use anti-single phasing protection that detects regenerative voltage (using the phase angle of the source) to determine a failed source condition.
- B. Voltage and Frequency Sensing:
  1. Undervoltage pick-up set at 90% of nominal voltage, adjustable 85% - 100% of nominal voltage.
  2. Undervoltage dropout set at 90% of pickup voltage, adjustable 75% - 98% of pickup voltage.
  3. Overvoltage dropout set at 110% of nominal voltage, adjustable 105% - 135% of nominal voltage.
  4. Overvoltage pick-up set at 95% of dropout voltage, adjustable 85% - 100% of nominal voltage.
  5. Voltage dropout time set at 0.5 seconds adjustable 0.1 – 9.9 seconds.
  6. Voltage accuracy: 2%.
  7. Under frequency pick-up set at 90% of nominal frequency, adjustable 85% - 95% of nominal frequency.

8. Under frequency dropout set at 99% of pick-up frequency, adjustable 95% - 99% of pick-up frequency.
  9. Over frequency dropout set at 101% of pick-up frequency, adjustable 101% - 105% of nominal frequency.
  10. Over frequency pick-up set at 110% of nominal frequency, adjustable 105% - 120% of nominal frequency.
  11. Frequency accuracy: 1%.
- C. Time Delays:
1. Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 3 seconds.
  2. Time delay for transfer to standby: Range 0-60 minutes. Factory set at 1 second.
  3. Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 15 minutes.
  4. Time delay for engine cool down: Range 0-60 minutes. Factory set at 0 minutes.
  5. Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.
  6. Pre-transfer to normal signal: Range 0-60 minutes. Factory set at 3 second.
  7. Pre-transfer to standby signal: Range 0-60 minutes. Factory set at 3 second.
  8. Post-transfer to normal signal: Range 0-60 minutes. Factory set at 0 minute.
  9. Post-transfer to standby signal: Range 0-60 minutes. Factory set at 0 minute.
  10. User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.
- D. The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.
1. Phase rotation sensing programmable ABC or CBA.
  2. In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED on the user interface panel shall indicate active in-phase monitoring.
  3. Plant Exerciser: Programmable seven-day or fourteen-day exerciser with user selectable load or no-load operation. An LED, on the user interface, shall indicate the type of exercise (load or no load). The time remaining on the exercise shall be indicated. The exercise time may be reset at any time with a

single keystroke. The engine shall be allowed to run when the exercise period is terminated. The exerciser may be disabled for maintenance purposes. An amber LED shall flash on the user interface if the exerciser has been disabled.

The exerciser shall have the capability of being programmed, using up to twenty-one (21) event for a calendar mode.

The controller shall have provisions for disconnecting a load bank (during exercise) if there is a loss of normal power.

4. The control module must be upgradable with the following options:
  - a. Supervised transfer control switch.
  - b. Provide four programmable input/output (I/O) modules with two inputs and six outputs each rated 2 amps @ 30 VDC/250 VAC.

## **2.05 MONITORING, PROGRAMMING AND COMMUNICATIONS**

### **A. Modbus® Link:**

1. Industry standard Modbus® RTU communication shall be available with network and setup connections.
2. A Modbus® master will be able to monitor controller data.
3. A Modbus® master will be able to alter parameters.
4. The Modbus® master must be capable of starting and stopping the generator.
5. The manufacturer shall provide a Modbus® communications protocol manual to facilitate communications with a Modbus® master by a third party developer.
6. The Modbus® network shall communicate to the controller using a twisted pair of wire.

### **B. Personal Computer Set-up/Monitoring Software:**

1. The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows '9X or Windows NT through an RS-232 communication format (in addition to the Modbus® connection).
2. The software shall be Windows® based.
3. The programming capability shall be password protected.

### **C. It shall be possible to start the generator and transfer the loads to the generator.**

### **D. Event monitoring shall be accessible using either a personal computer with the personal computer software or Modbus® link to view the following:**

1. Historical data (total and resettable).
2. Days in operation.

3. Hours in standby.
  4. Hours not in preferred.
  5. Switch transfers.
  6. Failure to transfer.
  7. Transfers due to loss of preferred.
  8. Start up date.
  9. Last maintenance date.
  10. Switch transfer count since last maintenance.
- E. Transfer Switch Information:
1. ATS serial number.
  2. Controller serial number.
  3. Contactor serial number.
  4. Load description.
  5. Location.
  6. Branch.
  7. Network connection ID.
  8. Baud rate.
  9. Parity bit.
- F. System events (time and date stamped) of the last 100 events which include all failures of the sources, transfer switch and all functions of the controller and contactor:
1. Line to line voltage.
  2. System frequency.
  3. Time delay active.
  4. Time delay remaining.
  5. System status.
  6. Source available.
  7. Contactor position.
  8. Exerciser schedule, mode and time remaining on active exercise.
- G. Programmable features may be viewed, selected or adjusted as follows:
1. System voltage.
  2. System frequency.

3. Single/three-phase operation.
  4. Open/closed-transition operation.
  5. ABC or CBA phase rotation.
  6. In-phase monitor.
  7. Commit/no commit transfer mode.
  8. User defined password.
- H. Programmable inputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
1. End time delay input.
  2. Inhibit transfer.
  3. Low external battery fault.
  4. Peak shave/area protection input.
  5. Remote common fault.
  6. Remote test.
- I. Programmable outputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
1. Auxiliary switch fault.
  2. Common fault.
  3. Contactor position.
  4. Exercise active.
  5. Failure to acquire standby source.
  6. Failure to transfer fault.
  7. Generator engine start.
  8. Load bank control.
  9. Los of phase fault.
  10. Low backup battery.
  11. No in automatic mode.
  12. Non-emergency transfer.
  13. Over and undervoltage faults.
  14. Over and under frequency faults.
  15. Peak shave/area protection active.
  16. Phase rotation error.

17. Modbus®-controlled relay outputs.
18. Source available.
19. Test active.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Floor-Mounted Switch: Level and anchor unit to floor.
- B. Identify components according to Division 16 Section "Electrical Identification."

#### **3.02 CONNECTIONS**

- A. Ground equipment as indicated and as required by NFPA 70.

#### **3.03 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing under the supervision of the manufacturer's factory-authorized service representative in addition to tests recommended by the manufacturer:
  1. Before energizing equipment, after automatic transfer switches have been installed:
    - a. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Meet manufacturer's specified minimum resistance.
    - b. Check for electrical continuity of circuits and for short circuits.
    - c. Inspect for physical damage; proper installation and connection; and integrity of barriers, covers, and safety features.
    - d. Verify that manual transfer warnings are properly placed.
    - e. Perform manual transfer operation.
  2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    - c. Verify time-delay settings.
    - d. Verify pickup and dropout voltages by data readout or inspection of control settings.



- e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
  - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown sequence.
- B. Coordinate tests with tests of generator plant and run them concurrently.
  - C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

### **3.04 CLEANING**

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean equipment internally, on completion of installation, according to manufacturer's written instructions.

### **3.05 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain transfer switches and related equipment as specified below:
  - 1. Coordinate this training with that for generator equipment.
  - 2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
  - 3. Review data in maintenance manuals. Refer to Division 1, Section "Maintenance Manuals."
  - 4. Schedule training with Owner, through Architect, with at least fourteen days' advance notice.
  - 5. Provide a minimum of four hours of instruction.

**END OF SECTION**

## SECTION 16442

### PANELBOARDS

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

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

##### 1.02 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices and associated auxiliary equipment rated 600 V and less for the following types:
  - 1. Lighting and appliance branch-circuit panelboards.
  - 2. Distribution panelboards.
  - 3. Transient voltage surge suppressor panelboards.
- B. Related Sections include the following:
  - 1. Section 16182 "Circuit Breakers."

##### 1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient voltage surge suppressor.

##### 1.04 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details.

- b. Bus configuration, current, and voltage ratings.
  - c. Short-circuit current rating of panelboards and overcurrent protective devices.
  - d. UL listing for series rating of installed devices.
  - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- D. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
- 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

#### **1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

#### **1.06 COORDINATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Div.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.

### **2.02 FABRICATION AND FEATURES**

- A. Enclosures: Surface mounted cabinets. NEMA Type 1 for indoor
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity.
- G. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

### **2.03 PANELBOARD SHORT-CIRCUIT RATING**

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current indicated on the drawings.

## **2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Branch Overcurrent Protective Devices: Bolt on circuit breakers, replaceable without disturbing adjacent units.
- B. Coordinate below with Drawings.
- C. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## **2.05 DISTRIBUTION PANELBOARDS**

## **2.06 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded-Case Circuit Breaker: NEMA 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
  - 6. GFCI Circuit Breakers: Single- and two-pole configurations with [5] [30]-mA trip sensitivity.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise

indicated.

- C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- E. Install filler plates in unused spaces.

### **3.02 IDENTIFICATION**

- A. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### **3.03 CONNECTIONS**

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.04 FIELD QUALITY CONTROL**

- A. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- B. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
  - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
  - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide

- calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

**3.05 ADJUSTING**

- A. Set field-adjustable circuit-breaker trip ranges.

**3.06 CLEANING**

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

**END OF SECTION**

## **SECTION 16461**

### **DRY TYPE TRANSFORMERS**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes dry type transformers operating at 600 volts or less of the following types:
  - 1. Single-Phase, 45 kVA.
  - 2. Control Power Transformers.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through Division 16 Specification Sections, apply to the Work of this Section as if specified herein.

##### **1.02 SUBMITTALS**

- A. General: Comply with the general requirements of the Contract governing submittals and the supplemental requirements specified in Specification Section 16010, "Basic Electrical Requirements." Provide submittals for each different type product specified herein.
- B. Field Tests Report: Submit Field Tests Report.
- C. Operation and Maintenance Data: Submit operation and maintenance data as part of the Operation and Maintenance manuals specified in Specification Section 16010, "Basic Electrical Requirements."

#### **PART 2 - PRODUCTS**

##### **2.01 GENERAL**

- A. Manufacturers: The following manufacturers may be capable of supplying acceptable products:
  - 1. Acme Electric Corp.; Transformer Division.
  - 2. Eaton Corp.; Cutler-Hammer Products.
  - 3. General Electric Co.; Electrical Distribution & Control Division.
  - 4. MagneTek Inc.



5. Sola/Hevi-Duty Electric.
  6. Square D Co.
  7. Virginia Transformer Corp.
- B. Factory Tests: Transformers shall be subjected to routine factory tests as required to demonstrate compliance with referenced standards.
- C. Description: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
- D. Cores: Grain-oriented, nonaging silicon steel.
- E. Coils: Copper. Continuous windings without splices, except for taps.
- F. Internal Coil Connections: Brazed or pressure type.
- G. Enclosure: NEMA 250 to meet the environmental conditions of the installed location.
- H. Finish: Manufacturer's standard gray enamel paint over corrosion-resistant pretreatment and primer.

## **2.02 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS**

- A. Comply with NEMA ST 20 and listed and labeled as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Windings: One coil per phase in primary and secondary.
- D. Enclosure: Indoor, ventilated, drip-proof.
- E. Insulation Class: 185 or 220 degrees C class for transformers 15 kVA or smaller; 220 degrees C class for transformers larger than 15 kVA.
- F. Rated Temperature Rise: 150 degrees C maximum rise above 40 degrees C, for 220 degrees C class insulation; 115 degrees C maximum rise for 185 degrees C class insulation.
- G. Taps: Two (2) 2-1/2 percent full-capacity taps above and four (4) 2.5 percent full-capacity taps below rated voltage in high-voltage windings.
- H. Fungus Proofing: Permanent fungicidal treatment for coil and core.

## **2.03 CONTROL POWER TRANSFORMERS**

- A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak

load by 100 percent minimum.

- C. Description: Self-cooled, 2 windings.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine elements and surfaces to receive dry type transformers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. Install dry type transformers in accordance with the manufacturer's published installation instructions.
- B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.
- C. Install dry type transformers level and secure. Provide for mounting and anchoring of dry type transformers in accordance with Specification Section 16050, "Basic Electrical Materials and Methods."
- D. Remove temporary lifting eyes, channels, and brackets.
- E. Bond X0 to ground in accordance with NEC requirements for bonding separately derived systems. Connect feeder/branch circuit equipment grounding conductor to dry type transformer ground lug.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- G. Identify dry type transformers in accordance with the requirements of Specification Section 16075, "Electrical Identification."
- H. Test installed dry type transformers in accordance with the paragraph, "Field Tests" below.

#### **3.03 FIELD TESTS**

- A. Perform tests only on dry type transformers, 3kVA and larger.
- B. Perform tests only after installed line- and load-side feeder circuits have been installed, tested and found to be in compliance with specified criteria.
- C. After dry type transformer is installed, but prior to energizing line- and load-side feeder circuits, perform the following minimum inspections and tests according to

manufacturer's published instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.

1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.
3. Insulation Resistance: Perform megohmmeter tests of primary and secondary windings, winding-to-winding and winding-to-ground.
  - a. Minimum Test Voltage: 1000 volts dc.
  - b. Minimum Insulation Resistance: 500 megohms.
  - c. Duration of Each Test: 10 minutes.
  - d. Temperature Correction: Correct results for test temperature deviation from 20 degrees C standard.
- D. Correct malfunctioning dry type transformers on-site, where possible, and retest to demonstrate compliance with specified criteria; otherwise, replace in kind with new and retest.
- E. Prepare and submit Field Tests Report in accordance with the requirements of Specification Section 16010, "Basic Electrical Requirements." Attach a label or tag to dry type transformer indicating satisfactory completion of tests.

### **3.04 ADJUSTING**

- A. Adjust dry type transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

**END OF SECTION**

## SECTION 16491

### FUSES

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, controllers, and motor-control centers; and spare fuse cabinets.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

##### 1.02 SUBMITTALS

- A. Product Data: Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings for each fuse type indicated.
- B. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 2. Let-through current curves for fuses with current-limiting characteristics.
  - 3. Time-current curves, coordination charts and tables, and related data.
  - 4. Fuse size for elevator feeders and elevator disconnect switches.
- C. Ambient Temperature Adjustment Information. If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses adjusted.
  - 1. For each adjusted fuse, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- D. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 1.

##### 1.03 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

## **1.04 PROJECT CONDITIONS**

- A. Where ambient temperature to which fuses are directly exposed is less than 40° F (4.4° C) or more than 100° F (38° C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## **1.05 COORDINATION**

- A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

## **PART 2 PRODUCTS**

### **2.01 FUSES REQUIREMENTS**

- A. Description: Nonrenewable, dual element, cartridge type; UL, Class as specified or indicated.
- B. Amperage: As indicated.
- C. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage indicated.
- D. Fuses up to 600 amperes: UL Class RK1 time delay, current limiting type, 200,000 A.I.C unless otherwise indicated.
- E. All fuses shall be of the same manufacturer.

### **2.02 SPARE FUSE CABINET**

- A. Cabinet: Wall-mounted, 0.05-inch thick steel unit with full-length, recessed piano-hinged door and hasp for user's padlock.
  - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification Label: "SPARE FUSES" in 1-1/2-inch high letters on exterior of door.
  - 4. Fuse Pullers: For each fuse size

### **2.03 EXTRA MATERIALS**

- A. Provide three of each size and type fuse installed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare fuses in fuse cabinet.

**3.03 IDENTIFICATION**

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

**END OF SECTION**

**DIVISION 17**  
**INSTRUMENTATION**

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**SECTION 17010**  
**INSTRUMENTATION**

**PART 1 GENERAL**

**1.01 DESCRIPTION**

- A. Provide elements of process instrumentation, auxiliary equipment, and supplies.
- B. The requirements specified in the Conditions of the Contract, Division 1 apply to this Section.
- C. Refer to Electrical sheets for Instrumentation, raceway and wiring. Refer to Mechanical sheets for sensors and control components.
- D. The work at Master Lifts Station Tara #20 shall include, but not necessarily be limited to:
  - 1. Furnish and install a new strap-on transit time flowmeter with transmitter and 4-20 mA output to the proposed Owner supplied Control Cabinet.
  - 2. Furnish and install a new pressure transducer/transmitter with 4-20 mA output to the proposed Owner supplied Control Cabinet for measuring pressure in the force main leaving the lift station.
  - 3. Furnish and install two new pressure transducer/transmitters for measuring wastewater level, one in each wet well, with 4-20 mA output to the proposed Owner supplied Control Cabinet.
  - 4. Furnish and install float type liquid level switches in the wet wells, as back-up for the pressure transducer, with output routed to the proposed Owner supplied Control Cabinet.

**1.02 RELATED WORK**

- A. Section 11319 – Submersible Pumps
- B. Section 16269 - Variable Frequency Controllers
- C. Division 16 - Electrical



## **1.02 SUBMITTALS**

- A. The submittals shall be in accordance with Division 1, Section 01340, as well as include the following:
  - 1. Manufacturer's data.
  - 2. Shop drawings.
  - 3. Certificates of compliance.
  - 4. Certified test reports.
  - 5. Operation and maintenance manuals.

## **1.03 QUALITY ASSURANCE**

- A. **Manufacturer.** Instrumentation, control and monitoring equipment furnished shall be manufactured by a firm regularly and currently engaged in the design and manufacture of similar equipment. Equipment furnished shall be new and of current design.
- B. **Maintainability.** Equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.
- C. **Materials and Installation** shall comply with the requirements of the referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. Equipment of the same type shall be a product of the same manufacturer. Capacities of equipment shall not be less than that indicated on the drawings or specified.
- D. All exterior mounted instruments shall be furnished with appropriately sized rain shields.

## **PART 2 PRODUCTS**

### **2.01 TRANSIT TIME FLOWMETER**

- A. Flowmeter shall be a transit time flowmeter, model Vantage 4400-AS1 by Eastech Badger, GE Panametrics AquaTrans AT 868 IP67/68, or approved equal.

B. Performance

1. Rangeability of 40 to 0.1 ft/sec
2. Turndown of 400:1
3. Repeatability of 0.25%
4. Accuracy of  $\pm 1\%$  of actual flow

C. Sensors

1. Sensors shall be strap-on and shall not penetrate the pipe. Sensors shall be rated for buried and submerged service and shall operate over a range of -30 to 150 degrees Fahrenheit. Sensors shall be constructed of anodized aluminum, Ultem®, and PVC.
2. Both sensors shall be mounted in a self-aligning mounting rail constructed of anodized aluminum that locks onto the pipe body. A V-Shot style sensor mounting (i.e., only one mounting rail) shall be utilized. Flowmeter with sensors mounted on both sides of the pipe will not be accepted.
3. Sensor cables shall be Triax Beldon 9222.

D. Transmitter

1. Transmitter shall be NEMA, 4, 4X, polycarbonate with door lock.
2. Transmitter shall be rated for -4 to 58 degrees Fahrenheit.
3. Transmitter shall have one 4-20 mA output, analog isolated into 800 ohms max, monitored to detect open circuits, RFI and gas discharge surge protection, and two fuses.
4. Display shall be backlit LCD with 124 x 64 graphic module
5. Data logging capability with non-volatile flash memory and storage up to 32,768 records.

E. Flowmeters shall be rated for submersible service.

F. Flowmeters shall be factory pre-programmed for 24" ductile iron pipe, raw wastewater, 100 psi max pressure, and unidirectional flow.

**2.02 PRESSURE TRANSDUCER**

- A. Pressure Transducer shall be model T2-7-MO2-42-F2 100 with a model 25-312SS-02T-CG diaphragm seal, both by Ashcroft.
- B. Performance Characteristics
  - 1. Range: 0 to 100 psi
  - 2. Accuracy: (static)  $\pm 0.25\%$  of span; ( $-4^{\circ}$  to  $185^{\circ}$  F)  $\pm 1.0\%$  of span
  - 3. Stability: less than  $\pm 0.25\%$  span / year
- C. Physical Characteristics
  - 1. Housing: 20% glass reinforced nylon, Nema 4X
  - 2. Pressure Connection: 304 Stainless Steel with  $\frac{1}{4}$ " NPT-Male
  - 3. Sensor Material: 17-4PH stainless steel
  - 4. Sensor Type: polysilicon thin film bridge
  - 5. Electrical Termination: Pigtail: 3-feet of shielded cable, PVC jacket, 24 AWG leads
- D. Electrical Specifications
  - 1. Output Signal: 4-20 mA (2 wire)
  - 2. Supply Voltage: 9-36 Vdc
- E. Diaphragm Seal
  - 1. All welded midi-seal with flushing connection
  - 2. Diaphragm Material: 316L stainless steel
  - 3. Bottom Housing Material: 316L stainless steel
  - 4. Process Connection:  $\frac{1}{4}$ " NPT – female
  - 5. Instrument Connection:  $\frac{1}{4}$ " NPT – female
  - 6. Filling Fluid: glycerin
- F. The pressure transducer shall be suitable for submersible service.

**2.03 PRESSURE TRANSDUCER – WASTEWATER LEVEL**

- A. Pressure Transducer for measuring wastewater level shall be model GSX3-PP050-A49-B49-XX-C01-D49 by Dylux (formerly Senex) of Grand Island, NY.
- B. The pressure transducer shall be suitable for submergence in raw wastewater and shall include a flush, clog-free sensor.
- C. Performance Characteristics
  - 1. Range: 0 to 5 psig
  - 2. Accuracy: (static)  $\pm 0.5\%$  FSO
  - 3. Stability: less than  $\pm 0.25\%$  FSO / year
  - 4. Repeatability: less than  $\pm 0.1\%$  FSO
- D. Physical Characteristics
  - 1. Housing: 316L Stainless Steel
  - 2. Electrical Connector: 1/2" NPT-Male submersible conduit with vented polyurethane cable
  - 3. Pressure Port: Flush sensor with 3" x 1" stainless steel standoff
- E. Electrical Specifications
  - 1. Output Signal: 4-20 mA (2 wire)
  - 2. Supply Voltage: 8-38 Vdc
  - 3. EMI / RFI Internal Filtering
  - 4. Voltage surge protection

**2.04 FLOAT TYPE LIQUID LEVEL SWITCHES**

- A. Liquid level switches shall be float switches suitable for raw wastewater service. Float switches shall be a single pole mercury switch designed to actuate when the longitudinal axis of the float is horizontal and deactuate when the liquid level falls one inch below the actuation elevation. The switching arrangement shall be normally open when deactivated. The switches shall be able to operate at a voltage of 24 vdc.

Liquid level switches shall be as manufactured by Anchor Scientific Inc or County approved equal.

**2.05 INSTRUMENT LOOP POWER SUPPLIES**

- A. An instrument loop power supply shall be provided for each loop, where required. The power supply shall be rated for 2.8 amps at 24 VDC and shall be output overload protected. Shall be factory wired for 120V AC, 60 Hz operation. The power supply shall be rated for operation in ambient conditions of 0-50 degrees C. Input protection shall be provided in the form of a 1 amp fuse or circuit breaker. Provide a Blown Fuse Indicator across the protective circuit for positive visual verification of an open condition. The power supply shall be a Model SPS 30-24/28 as manufactured by ACME or approved equal.

**2.06 TRANSIENT PROTECTION/SURGE SUPPRESSION DEVICES**

- A. Surge and transient protection devices shall be provided for 4-20 mA loops where not provided by panel originating loop. They shall be two-stage units incorporating gas tube and electronic clamping. Either polarity in surges shall be equally protected. The protection devices shall provide long life, reliability and easy mounting. Surge protection devices for 4-20 mA loops shall add no more than 50 ohms to the circuit and provide impulse clamping levels of 100V maximum for line-to-line and 50V maximum for line-to-ground. Surge protection devices for instrument loops of 4-20 mA shall be Model 1669-02 as manufactured by Joslyn Electronic Systems Corporation.

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. Install all system components in accordance with the Drawings, manufacturers' recommendations, and approved Shop Drawings. Provide all necessary interconnection, services, and adjustments necessary for a complete, operational and fully functional system.
- B. All electrical work shall be accordance with NEC and Division 16 of these Specifications. Install all control wiring / cabling, without splices between terminal points. Group, bundle, train and route wires and cables, as required for a neat and professional looking wiring / cabling system in accordance with the best practice known to the industry.
- C. All wires entering / exiting control enclosures shall be terminated on terminal blocks. All terminal blocks shall be permanently, legibly labeled with the unique identification number of the wire terminated thereon.

- D. Maintain a minimum 6-inch separation between discrete I/O wiring and analog cabling / wiring. Provide separate plastic wireways to segregate discrete I/O wiring from analog I/O cabling / wiring.
- E. Provide surge protection on all control and control power circuits routed outside of the control building. Surge protection shall be per data transmission equipment manufacturer's requirements. Surge protection shall consist of surge suppressors, transient protectors and optical isolated relays as applicable.
- F. All field-mounted instruments shall be protected and isolated from vibration, temperature extremes, radiant heat, rain, sleet or falling water, and similar adverse conditions.
- G. Field mounted elements shall be marked with data required for calibration such as location of adjustments, span, offset, zero suppression, and test voltages. If such data are not provided in permanent markings or on the manufacturer's nameplate, a durable tag or label shall be affixed in a protected location that will become readily visible in the normal course of servicing the instrument.

### **3.02 EXAMINATION**

- A. Verify that systems are ready to receive work.
- B. Commencing installation of Division 11 specified systems means the Division 11 Installer accepts existing conditions without exception.

### **3.03 INSPECTION**

- A. Inspect work in progress for compliance with manufacturer specified tolerances.

### **3.04 DELIVERY, STORAGE AND HANDLING**

- A. Provide factory shipping cartons for each piece of equipment and control device. Provide factory applied plastic end caps on each length of pipe and tube. Maintain cartons and end caps through shipping, storage and handling as required to prevent equipment and pipe-end damage, and to eliminate dirt and moisture from equipment and inside of pipe and tube. Store equipment and materials inside and protected from weather.

### **3.05 IDENTIFICATION**

- A. Piping and Cabling / Wiring: Tag control piping and cabling / wiring at each end and at accessible junction points as specified herein, in accordance with Division 16. Develop and apply a logical alphanumeric identification scheme uniquely identify

each wire / cable. The unique identification should relate the wire to the programmable logic controller, the I/O card and the type of device to which the wire is connected.

**3.06 WIRING**

- A. General: Provide surge protection on all discrete control, signal and power circuits routed outside of the Operations Building. Surge protection shall be per data transmission equipment manufacturer's requirements. Surge protection shall consist of surge suppressors, transient protectors and optically isolated relays as applicable.

**3.07 EQUIPMENT TESTING AND CALIBRATION**

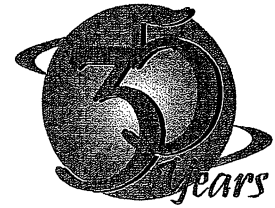
- A. General: Provide Construction Manager-approved operation and acceptance testing of the complete system. The Resident Engineer's representative will witness all tests.
- B. Factory Tests and Calibration. All field-mounted elements shall be factory-tested by the manufacturer to assure satisfactory performance prior to shipment to the job site. Whenever possible, this shall include calibration to the actual range and conditions of use. Calibration shall be traceable to the National Bureau of Standards with an uncertainty not more than 1/2 of the specified or claimed accuracy of the instruments.
- C. Field Calibration. Field mounted elements which were not calibrated to final working values of range, span, and zero suppression at the factory shall be so calibrated prior to or at the time of installation. This calibration shall meet the same requirements of accuracy and traceability required for factory testing above. The engineer shall be given 48 hours notice and the opportunity to witness this calibration.
- D. Field Test: When installation and field calibration is complete, verify transmission media operation before the system is placed on-line. Provide a detailed crosscheck of each sensor within the system by making a comparison between the reading at the sensor and a standard traceable to the National Bureau of Standards. Provide a crosscheck of each control point within the system by making a comparison between the control command and the field-controlled device. Submit the results of functional and diagnostic tests and calibrations to the Engineer for final system acceptance.

**END OF SECTION**

**SUPPLEMENTAL INFORMATION**  
**GEOTECHNICAL REPORT**

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September 11, 2008

URS Corporation  
7650 W. Courtney Campbell Causeway  
Tampa, Florida 33607

Attention: Ms. Rebecca Avalos

Reference: Report of Subsurface Exploration  
Proposed Electrical Building and Emergency Generator Area  
Master Lift Station Tara 20  
7211 Stone River Road  
Bradenton, Florida  
Test Lab Project No: **08-3431**

Dear Ms. Avalos:

As authorized, a subsurface exploration was performed for the proposed electrical building and emergency generator area to be constructed at 7211 Stone River Road in Bradenton, Florida. The proposed field exploration consisted of performing one (1) exploratory boring in the proposed building area and one (1) exploratory boring in the proposed concrete pad for emergency generator area. The following report briefly describes the field test procedures used for this study and presents the findings, an engineering evaluation of the subsurface conditions and geotechnical recommendations for the proposed building and emergency generator area.

#### **EXPLORATION PROGRAM**

Two (2) exploratory borings were performed with a truck mounted CME-45B drilling rig at the locations shown on the accompanying Boring Location Plan. To protect the underground utility lines, a hand auger boring with associated dynamic cone penetration test was performed to a depth of 4 feet at each boring location. Then, conventional rotary drilling procedures were utilized along with a bentonite drilling fluid to stabilize the bore hole. The standard penetration test was performed and split-barrel soil samples obtained at intervals of 2 feet to a depth of 10 feet and intervals of 5 feet thereafter. The following is a brief description of this field test procedure.

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The exploratory borings were performed in accordance with ASTM Specification D-1586, entitled "Standard Method for Penetration Test and Split-Barrel Sampling of Soils." After drilling to the required depth and cleaning the bore hole, the sampler (2" O.D.) was driven 18 or 24 inches into the undisturbed soil by a 140-pound drop-hammer falling 30 inches. The number of blows required to drive the sampler the second and third 6-inch increments is known as the "Standard Penetration Resistance" (N). The numerals in parentheses below the 'N' values are the blow counts for each of the 6-inch increments that the split-barrel sampler was driven. The various soils encountered in the boring were visually classified in the field and representative soil samples obtained for further examination by a geotechnical engineer. The soils encountered in the borings were classified utilizing the "Unified Soil Classification System."

Two (2) hand auger borings supplemented with dynamic cone penetrometer were performed at the proposed boring location from existing ground surface to a depth of 4 feet. The auger borings were performed by manually advancing a 3¼ inch diameter bucket auger in small increments. As each soil type was revealed, its depth interval was recorded and a representative sample was obtained for review by a geotechnical engineer. At the completion of the drilling operations, the soil samples obtained from the borings were transported to the laboratory where they were examined by a geotechnical engineer. The soils were visually classified in accordance with the "Unified Soil Classification System."

The data obtained from the borings are presented on the accompanying logs. Also attached is a legend explaining the classification terms and symbols used on the logs.

#### **SITE CONDITIONS**

The project site is located at 7211 Stone River Road in Bradenton, Florida. An existing Manatee County Sewage Pumping Station 323 with associated facilities was observed at the referenced site. At the time of this exploration, the referenced site was easily accessible by our truck mounted drill rig.

### **SUBSURFACE CONDITIONS**

The following is a generalization of the subsurface conditions revealed during the field exploration.

#### **Proposed Building Area** (Boring B-1)

Boring B-1 & DCP-1 encountered fill materials consisting of dark gray-brown and gray-brown fine sand with clay chunks and limestone fragments from existing ground surface elevation to a depth of 4 feet, subsequently underlain by semi-cohesionless very loose to loose light gray-brown and gray-brown slightly clayey fine SAND with cemented sand from 4 feet to 12 feet. Beneath the semi-cohesionless materials, cohesive medium stiff gray-brown fine sandy calcareous CLAY with limestone was encountered to boring terminal depth of 15 feet.

#### **Proposed Emergency Generator Area** (Boring B-2)

Boring B-2 & DCP-2 encountered fill materials consisting of gray-brown fine sand with limestone fragments from existing ground surface elevation to a depth of 4 feet, subsequently underlain by semi-cohesionless very loose to loose light gray-brown and gray-brown slightly clayey fine SAND with cemented sand from 4 feet to 12 feet. Beneath the semi-cohesionless materials, cohesive medium stiff gray-brown fine sandy CLAY with limestone was encountered to boring terminal depth of 15 feet.

The accompanying logs should be reviewed for a description of the specific conditions encountered at each boring location.

### **GROUND WATER CONDITIONS**

The water table was encountered at a depth of 6.7 and 6.4 feet below existing ground surface elevation at boring locations B-1 and B-2, respectively. Fluctuations of the water table should be expected during the year due to local amounts of rainfall, site development and other factors. The United States Department of Agriculture "Soil Survey of Manatee County, Florida" indicates that the shallow soils at the site are composed of EauGallie and/or Wabasso Fine Sand. According to the soil survey, seasonal high ground water for this type of undrained soil will be at a depth within 10 inches below the existing ground surface. Based on the conditions revealed at the site, the soils in this area are artificially drained by sewer systems, gutters, tile drains and surface ditches. It is estimated that seasonal high ground water will be approximately 4.0 feet below existing grade during the height of the rainy season at all boring locations.

### **BUILDING DESIGN DATA**

The foundation conditions were evaluated by comparing the subsurface characteristics of this site with previously made correlations of such data and foundation stabilities that have been developed for similar conditions. The following is the building design data upon which the evaluation of the foundation conditions is based.

The size, configuration and location of the proposed building and future development are shown on the accompanying Boring Location Plan. It is assumed that the building will be a single-story structure with load bearing masonry walls and a cast-in-place concrete structure. Column and wall loads for the structure are expected to be in the range of 15 to 20 kips and 2.5 kips per linear foot, respectively. The ground floor slabs will be soil supported near the existing grade so that very little fill will be needed in the building area.

### **EVALUATION**

The field exploration revealed one subsurface condition of concern. That is, the shallow loose cohesionless soils at near surface. However, this is not a serious problem as it can be remedied by proper preconstruction site preparation. In the building and emergency generator areas, proof-roll the exposed subgrade to a distance of seven (7) feet beyond the building footprint with a heavy drum-type vibratory compactor to adequately densify of 98% of Modified Proctor maximum dry density. After the recommended site preparation is undertaken, the proposed building and emergency generator pad areas can be supported on a conventional monolithic shallow foundation and floor slab-on-grade system.

### **RECOMMENDATIONS**

#### **Site Preparation**

The site should be stripped topsoil and organics. Then the stripped building and emergency generator subgrade areas should be recompacted to a minimum distance of seven (7) feet beyond the exterior foundation, a heavy drum-type vibratory compactor having a minimum static weight of 15,000 pounds. Proof-rolling of the building area, to seven (7) feet beyond construction lines, should consist of at least 10 complete coverages by the compaction equipment. It is recommended that the proof-rolling operation be observed under the supervision of the geotechnical engineer or his representative to provide assurance that the minimum recommended number of passes are applied. The vibratory compactor should be operated at a speed less than 1 mph. Compaction should continue until the soil 1 foot below the compaction surface attains a density of at least 98 percent of the maximum dry density as indicated by the Modified Proctor compaction test (ASTM D-1557). Dynamic compaction should not be used if existing structures are within 20 feet of the area being compacted.

### **Ground Water Control**

The water table is not expected to pose any problems during general site preparation and foundation construction. Any water in excavations can probably be controlled by pumping from sumps located in the excavations. Deep utility installation, however, may require installing and continuously operating a well-point dewatering system.

### **Fill Requirements**

Fill and backfill required in the building area should be a suitable material, which is placed in thin, properly compacted lifts. Material to be used for fill and backfill should be an inorganic soil of low plasticity, preferably clean sand containing less than 12 percent of the material passing a No. 200 sieve. The data obtained from the borings drilled at the site and within and proposed pond area, indicate that the shallow cohesionless soils at the site are suitable for use as structural fill. Fill and backfill beneath foundations should be compacted to at least 98 percent of the maximum Modified Proctor dry density; whereas fill and backfill that will support only floor slabs or pavement need only be compacted to at least 95 percent of the maximum Modified Proctor dry density.

The permissible thickness of fill and backfill lifts will depend upon both the nature of the soil and the type of compaction equipment used. When clean sand is used for fill and backfill, lifts up to 12 inches in thickness may be placed if heavy drum-type vibratory compaction equipment is used; whereas lifts should be limited to a maximum of 8 inches in thickness if either the fill and backfill is slightly cohesive or medium-weight drum-type vibratory compaction equipment is used. In restricted working areas, such as when backfilling around foundations or in service line trenches beneath slabs-on-grade or pavement, lightweight manually guided vibratory compaction equipment may be used. But when such light equipment is used, lifts of fill and backfill should be limited to a maximum of 4 inches in thickness.

### **Foundation Design**

When the building and emergency generator areas have been prepared as recommended, a conventional monolithic shallow foundation and floor slab-on-grade system may be used to support the structure. The building foundations may be designed utilizing a maximum allowable net soil bearing pressure of 2,000 psf. The column and/or wall foundations should have a minimum dimension of 24 inches and should bear at least 18 inches below the adjacent grade. Prior to the placement of foundation steel and concrete, the bottom of foundation excavations should be compacted with light-weight manually-guided vibratory compaction equipment to redensify any soil loosened by the excavation process. Field density tests should be taken to verify that the subgrade is adequately proof-rolled and that all fill and backfill are properly placed and compacted. We would be pleased to provide the necessary quality control inspection of the compaction

grouting, subgrade preparation, backfill and fill densification, concrete and other construction materials, should you so desire.

### **Settlement Considerations**

Preliminary settlement analyses were made for the proposed building and emergency generator areas. Based on the site preparation and foundation design recommendations made in this report, it is estimated that the total settlement of the buildings will be less than 1 inch. Differential settlements within the structures should be less than half of the total settlement. Most of the settlement of the proposed buildings should occur during construction.

### **LIMITATIONS**

This foundation study was undertaken for design purposes only. Generally accepted geotechnical engineering practices were utilized in the preparation of this report; and no other warranty, either expressed or implied, is made as to the professional advice provided. The report is based upon the design information provided as discussed in this report. Consequently, we can assume no responsibility for misinterpretation or misapplication of these recommendations unless given an opportunity to review any changes in either the design or location of the structure, which may affect their validity. This report has been prepared solely for the use of our client and may not contain sufficient information for other uses or for the purposes of other parties. Therefore, conclusions or recommendations based upon these data but made by others are not our responsibility. The following are other limitations that are applicable to this report.

The borings were not located by a survey crew, but rather our drill crew utilized a tape to locate the borings by scaling and measuring from reference points shown on the plan furnished us and found in the field angles were turned at 90 degrees. The boring locations are accurate only to the degree implied by the method used.

The lines on the logs designating the interface between the various strata may only be approximate boundaries when the transition is gradual or could not be detected by the drilling operations.

The depth to the groundwater table measured at the site during the investigation is only indicative of the conditions at that time. The groundwater table may fluctuate significantly due to seasonal changes, variations in rainfall, and other factors not evident at the time of the investigation nor reported herein.

The engineering evaluation, opinions, conclusions and recommendations presented in this report are based upon the data obtained from the borings made at the locations indicated on the plan; and are only valid so long as the site and subsurface conditions remain unchanged. This report does not reflect any variations that may occur between these borings, except as may be discussed in the report. The nature and extent of subsurface variations at the site may not become evident until during construction. Such variations should be observed to note their nature and re-evaluate and modify, if necessary, the recommendations presented herein.

The site is underlain by limestone bedrock that is susceptible to dissolution and the subsequent development of karst features such as voids and sinkholes in the natural soil overburden. Construction in a sinkhole prone area is therefore accompanied by some risk that internal erosion and ground subsidence could affect new structures in the future. It is not possible to investigate or design to completely eliminate the possibility of future sinkhole related problems. In any event, the owner must understand and accept this risk.

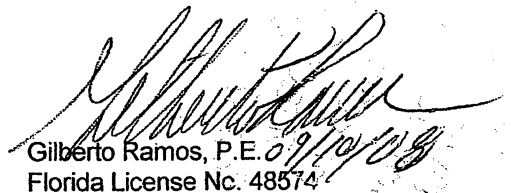
In view of the possibility of variations in subsurface conditions being encountered during construction, it is suggested that we be retained to perform on-site review of the site preparation and foundation phases of the construction. Otherwise, we can assume no responsibility for construction compliance with our site preparation recommendations.

Test Lab, Inc. appreciates the opportunity to have been of service. If there are any questions concerning this investigation, or if we may be of any further assistance, please do not hesitate to contact us.

Respectfully submitted,  
Test Lab, Inc.

 09/11/08

Mark S. Chomtid, Ph.D., P.E.  
Staff Geotechnical Engineer

 09/10/08  
Gilberto Ramos, P.E.  
Florida License No. 48574

Copies Submitted: (2) Client

Enclosures: Boring Location Plan  
Boring (B-1 & DCP-1 and B-2 & DCP-2)  
Soil Legend





<b>PROJECT:</b> Expansion of Master Lift Station Tara 20 Bradenton, Florida	<h2 style="margin: 0;">LOG OF BORING B-1</h2>
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DRILLER: <i>J. Davis</i>	ELEVATION: <i>N/A</i>	REMARKS: Bore hole grouted.
DATE DRILLED: <i>9/8/08</i>	WATER LEVEL: <i>8'8" @ TOB</i>	
DRILLING METHOD: <i>Mud Rotary</i>	BORING DEPTH: <i>15 Feet</i>	

DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)	STANDARD PENETRATION TEST DATA (blows/ft)				
				10	30	50	70	90
0		gray-brown fine SAND (fill)						
1		dark gray-brown fine SAND w/green clayey chunks & limestone (fill)						
2		gray-brown fine SAND (fill)						
3		loose gray-brown slightly clayey fine SAND						
4		loose gray-brown slightly clayey fine SAND	Hand Augered to 4 feet. Probing for Buried Utilities.					
5		very loose light gray-brown slightly clayey fine SAND w/cemented sand	6 (2,2,4,5)					
6		loose gray-brown slightly clayey fine SAND	6 (4,4,2,2)					
7		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)	2 (1,1,1)					
8		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)						
9		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)						
10		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)						
11		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)						
12		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)						
13		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)						
14		medium stiff gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)						
15		Boring terminated at 15'0"	8 (2,3,5)					
16		Boring terminated at 15'0"						
17		Boring terminated at 15'0"						
18		Boring terminated at 15'0"						
19		Boring terminated at 15'0"						
20		Boring terminated at 15'0"						

TEST LAB, INC.

PENETRATION TEST NO.: DCP-1		<b>Dynamic Cone Penetrometer Test Results</b>	
PROJECT: <i>Expansion of Master Lift Station Tare 20</i>			
TOTAL DEPTH: <i>4 Feet</i>		PROJECT NO: <i>08-3431</i>	
WATER LEVEL: <i>Not Encountered</i>		TEST DATE: <i>9/8/08</i>	
*Dynamic Cone Penetration number **Nequiv.-Equivalent Standard Penetration Test 'N' value Ref: ASTM Special Publication #399		REMARKS:	

DEPTH feet	DESCRIPTION AND REMARKS	DC No.*	Nequiv.**
	gray-brown fine SAND (fiii)	(1,5,8)	5
	dark gray-brown fine SAND w/green clayey chunks w/limestone (fiii)	(8,28,0)	29
	gray-brown fine SAND (fiii)	(8,28,30)	29
	Boring terminated at 4'0"	(22,28,40)	33

TEST LAB, INC.

PROJECT:		LOG OF BORING B-2		
Expansion of Master Lift Station Tara 20 Bradenton, Florida		DRILLER: <i>J. Davis</i>		ELEVATION: <i>N/A</i>
DATE DRILLED: <i>9/8/08</i>		WATER LEVEL: <i>6'5" @ TOB</i>		REMARKS: Bore hole grouted.
DRILLING METHOD: <i>Mud Rotary</i>		BORING DEPTH: <i>15 Feet</i>		
DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/8 in.)	
				10 30 50 70 90
		gray-brown fine SAND (fill)		
		gray-brown fine SAND w/trace of limestone (fill)		
		loose gray-brown slightly clayey fine SAND		
5		loose gray-brown clayey fine SAND	7 (4,4,3,3)	
		very loose light gray-brown slightly clayey fine SAND	7 (4,3,4,4)	
10		medium stiff light gray-brown fine sandy CLAY w/limestone	2 (1,1,1)	
		medium stiff light gray-brown fine sandy CLAY w/limestone		
15		Boring terminated at 15'0"	8 (3,3,5)	
20				












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PENETRATION TEST NO.: DCP-2	<b>Dynamic Cone Penetrometer Test Results</b>
PROJECT: <i>Expansion of Master Lift Station Tara 20</i>	
TOTAL DEPTH: <i>4 Feet</i>	PROJECT NO: <i>08-343f</i>
WATER LEVEL: <i>Not Encountered</i>	TEST DATE: <i>9/8/08</i>
*Dynamic Cone Penetration number **Nequiv.-Equivalent Standard Penetration Test 'N' value Ref: ASTM Special Publication #399	REMARKS:

DEPTH feet	DESCRIPTION AND REMARKS	DC No.*	Nequiv.**
	gray-brown fine SAND (fill)	(3,4,7)	5
	gray-brown slightly clayey fine SAND w/trace of limestone (fill)	(8,15,21)	18
		(9,18,18)	18
	Boring terminated at 4'0"	(15,15,12)	13

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## SOIL SYMBOLS

	SAND		VOID/CAVITY		PEAT, MUCK, ORGANIC SOILS
	CLAYEY SAND SILTY SAND		WEATHERED LIMESTONE		MISCELLANEOUS FILL, TOPSOIL, ETC.
	SANDY CLAY SANDY SILT		LIMESTONE		SHELL
	CLAY, SILT, SILTY CLAY, CLAYEY SILT		GRAVEL, COBBLES, BOULDERS		

## PARTICLE SIZE IDENTIFICATION

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- 4.7mm to 3 inches
Sand	- Course 2.00 to 4.74mm (dia. of pencil lead)
	- Medium 0.42 to 2.00mm (dia. of broom straw)
	- Fine 0.074 to 0.42mm (dia. of human hair)
Silt	- 0.074 to 0.002mm (cannot see particles)
Clay	- Smaller than 0.002mm

## CONSISTENCY

<u>COHESIONLESS SOIL</u> (sand)		<u>COHESIVE SOIL</u> (clay, silt)	
Very Loose	0 - 4 Blows/Ft.	Very Soft	0 - 2 Blows/Ft.
Loose	5 - 10 Blows/Ft.	Soft	3 - 4 Blows/Ft.
Firm	11 - 20 Blows/Ft.	Medium Stiff	5 - 8 Blows/Ft.
Very Firm	21 - 30 Blows/Ft.	Stiff	9 - 15 Blows/Ft.
Dense	31 - 50 Blows/Ft.	Very Stiff	16 - 30 Blows/Ft.
Very Dense	51 - UP Blows/Ft.	Hard	31 - 50 Blows/Ft.
		Very Hard	51 - UP Blows/Ft.

**Strata Changes** - In the column "Soil Descriptions" on the drill log the horizontal lines represent strata strata changes. A solid line (—) represents an actually observed change, a dashed line (- - -) represents an estimated change.

**Ground Water** - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.

# SOIL LEGEND

**TEST LAB** INC.  
GEOTECHNICAL & MATERIALS  
ENGINEERING, TESTING & INSPECTION