

MANATEE COUNTY GOVERNMENT
INVITATION FOR BID (IFB) #09-0250DC
NORTH REGIONAL WATER RECLAMATION FACILITY
(NRWRF) INFLUENT STRUCTURE

Manatee County, a political subdivision of the state of Florida, (hereinafter "Manatee County" or the "County" or "Owner") will receive sealed bids or proposals 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 AND SITE VISIT

In order to insure that all prospective bidders or proposers have sufficient information and understanding of the County's needs, an information conference will be held **December 9, 2008 at 10:00 A.M.** at the Manatee County Administrative Center, Purchasing Conference Room, 1112 Manatee Avenue West, Suite 803, Bradenton, Florida. All interested bidders are encouraged to attend.

An inspection of the project site will immediately follow the Information Conference. Note Article A.02 - inspection of the site is a requirement to be considered for award of this contract. Location: North Regional Water Reclamation Facility, 8500 69th Street East, Ellenton, Florida.

TIME AND DATE DUE: January 22, 2009 at 3:00 P.M.

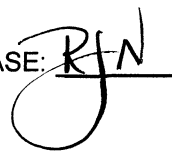
Manatee County Purchasing, 1112 Manatee Avenue West, Bradenton, FL 34205

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Important Note: A prohibition of Lobbying has been enacted. Please review paragraph A.21 carefully to avoid violation and possible sanctions.

FOR INFORMATION CONTACT:
DEBORAH CAREY-REED
(941) 749-3074 FAX (941) 749-3034

AUTHORIZED FOR RELEASE: 



October 13, 2008

To All Bidders

Subject: North Water Reclamation Facility (NWRf) – Influent Structure

The “construction cost estimate” for the North Water Reclamation Facility (NWRf) Influent Structure is \$5,018,000.00 (five million eighteen thousand dollars and no cents).

This construction cost estimate was determined as of October 13, 2008. The construction cost estimate is based on the original specifications and drawings issued on October 2008. Changes to the specifications subsequent to the original documents by addenda to this bid may not be accounted in this construction cost estimate.

Sincerely,

URS Corporation

A handwritten signature in black ink, appearing to read "D. Wilcox", with a long horizontal line extending to the right.

David A. Wilcox P.E.
Group Manger
Water/Wastewater Group
Engineer of Record for NWRf – Influent Structure

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: 6011281 9.1
URS File 12007031 (6300)

SECTION 00010
INFORMATION TO BIDDERS OR PROPOSERS

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 proposers or their representatives are invited to be present.

A.02 INSPECTION OF THE SITE

Prior to the submission of a bid, each bidder or proposer shall visit the site to become familiar with all conditions that may affect services that are required to completely execute the full intent of these specifications. For **coordination of site inspection**, bidders shall contact the Owner's Representative, **Chris West, Chief Operator, at 941-792-8811 extension 5424**. Inspection of the site is a requirement to be considered for award of this contract.

A.03 BID AND PROPOSAL DOCUMENTS

Manatee County Purchasing Office posts **notices of bid or proposal opportunities and addenda** on the Purchasing Office'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 recording or a printed copy of the documents requested. 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 services 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.

A.03 BID AND PROPOSAL DOCUMENTS (cont'd)

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 document detail, subsection "Pre Bid Conference" on the Onvia DemandStar web pages.

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://demandstar.com>, or by calling 800-331-5537, if you have any questions.

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

IF YOU OBTAIN A COPY OF THIS BID OR PROPOSAL DOCUMENT FROM OTHER THAN REGISTERING WITH ONVIA DEMANDSTAR WEB SERVICE FOR THIS SPECIFIC DOCUMENT – 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 questions on this instruction.

A.04 BID FORM DELIVERY REQUIREMENTS

Any bids or proposals received after the stated time and date will not be considered. It shall be the sole responsibility of the bidder or proposer to have their bid or proposal delivered to the Manatee County Purchasing Office for receipt on or before the stated time and date. If a bid or proposal is sent by U.S. Mail, the bidder or proposer shall be responsible for its timely delivery to the Purchasing Office. Bids or proposals 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 respondent's request and expense.

A.05 CLARIFICATION & ADDENDA

Each bidder or proposer shall examine all Invitation For Bid or Request for Proposal documents and shall judge all matters relating to the adequacy and accuracy of such documents. Any inquiries, suggestions or requests concerning interpretation, clarification or additional information pertaining to this Invitation For Bid or Request for Proposal 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.

A.05 CLARIFICATION & ADDENDA (cont'd)

If any addenda are issued to this Invitation For Bid or Request for Proposal, the County will BROADCAST THE ADDENDA ON ONVIA DEMANDSTAR TO "PLANHOLDERS" IDENTIFIED ON THIS WEB SERVICE, however, it shall be 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 cover page) to determine if addenda were issued and to make such addenda a part of their bid or proposal.

A.06 SEALED & MARKED

Three signed copies of your bid shall be submitted in one sealed package, clearly marked on the outside "Sealed Bid #09-0250DC NRWRF Influent Structure with your company name.

Address package to: Manatee County Purchasing Office
 1112 Manatee Avenue West, Suite 803
 Bradenton, Florida 34205

A.07 LEGAL NAME

Bids or proposals shall clearly indicate the legal name, address and telephone number of the bidder or proposer. Bids or proposals shall be signed above the typed or printed name and title of the signer. The signer must have the authority to bind the bidder or proposer to the submitted bid or proposal.

A.08 BID AND PROPOSAL EXPENSES

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

A.09 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 or services set forth in the attached specifications until one or more of the bids have been duly accepted by the County.

A.10 RESERVED RIGHTS

The County reserves the right to accept or reject any and/or all bids or proposals, to waive irregularities and technicalities, and to request resubmission. Also, the County reserves the right to accept all or any part of the bid or proposal 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 each item or 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 specifications or otherwise required by the County, and who is fit and capable to perform the bid as made.

A.10 RESERVED RIGHTS (cont'd)

To be responsive, a bidder or proposer shall submit a bid or proposer which conforms in all material respects to the requirements set forth in this Invitation For Bid or Request for Proposal. To be a responsible bidder or proposer, the bidder or proposer 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 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. Any 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 bid or 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 bid or proposal. The protest shall be submitted within seven calendar days after such aggrieved person knows or could have reasonably been expected to know of the facts giving rise thereto.

A.12 CODE OF ETHICS

With respect to this bid or 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 in 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 bid or proposal or from furnishing the goods or services for which the bid or 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 bid or proposal will be truthful. If a bidder or proposer is determined to be untruthful in its bid or 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.13 COLLUSION

By offering a submission to this Invitation For Bid or Request for Proposal, the bidder or proposer certifies that he has not divulged, discussed or compared their bid or proposal with other bidder or proposer, and has not colluded with any other bidder or

A.13 COLLUSION (cont'd)

proposer or parties to this bid or proposal whatsoever. Also, bidder or proposer certifies, and in the case of a joint bid or proposal 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 or proposal have not been knowingly disclosed by the bidder or proposer and will not knowingly be disclosed by the bidder or proposer, 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 or proposer to induce any other person or firm to submit or not to submit a bid or proposal for the purpose of restricting competition;
- d. the only person or persons interested in this bid or proposal, principal or principals is/are named therein and that no person other than therein mentioned has any interest in this bid or proposal 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 or proposer for purpose of doing business.

A.14 BID OR PROPOSAL FORMS

Bids or proposals must be submitted on attached County forms, although additional pages may be attached. **Bidders or proposers must fully comply with all bid or proposal specifications, 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 or proposal; and not shown separately. The prices as shown on the bid or proposal 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; FL Sales Tax Exempt Cert. No. **51-02-027548-53C**); therefore, the vendor is prohibited from delineating a separate line item in his bid or proposal for any sales or service taxes. Nothing herein shall affect the vendor's normal tax liability.

A.17 MATHEMATICAL ERRORS

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

A.18 DESCRIPTIVE INFORMATION

Unless otherwise specifically provided in the specifications, 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 specifications, 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 MODIFICATION OF BID OR PROPOSAL SPECIFICATIONS

If a bidder wishes to recommend changes to the bid or proposal specifications, the bidder or proposer shall furnish in writing, data and information necessary to aid the County in evaluating the request to modify the specifications. The County is not obligated to make any changes to the bid or proposal specifications. Unless an addendum is issued as outlined in paragraph A.05, six calendar days prior to the this bid or proposal, the bid or proposal specifications shall remain unaltered. **Bidders or proposers must fully comply with the bid or proposal specifications, terms, and conditions.**

A.20 AMERICANS WITH 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 or Proposal Opening**, should contact the person named on the first page of this bid or proposal document at least twenty four (24) hours in advance of either activity.

A.21 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 Bid or Request For Proposal with any officer, agent or employee of Manatee County other than the Purchasing Director or as directed in the Invitation For Bid or Request For Proposal. This prohibition begins with the issuance of any Invitation For Bid or Request For Proposal, and ends upon execution of the final contract or when the invitation or request has been canceled. 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 the Purchasing Office, in writing.

A.22 DRUG FREE WORK PLACE

The Manatee County Board of County Commissioners adopted a policy regarding bidders or proposers maintaining a Drug Free Work Place, prohibiting the award of bids or proposals 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 or proposal for this purpose.

A.23 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 or proposer on a contract to provide any goods or services to a public entity, may not submit a bid or proposal on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids or proposals 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 1/01/2005 is \$25,000) for a period of 36 months from the date of being placed on the convicted vendor list.

A.24 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.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 vendors 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 or proposals 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.

A.27 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 proposals become "Public Records" ten (10) days after the bid or proposal opening or if an award decision is made earlier than this time as provided by Florida Statue 119.071. No announcement or review of the bid or proposal documents shall be conducted at the public opening of the bids or proposals.

NOTE: ANY OR ALL STATEMENTS CONTAINED IN THE FOLLOWING SECTIONS; BASIS OF AWARD, TERMS AND CONDITIONS OF THE CONTRACT, OR SPECIFICATIONS WHICH VARY FROM THE INFORMATION TO BIDDERS OR PROPOSERS 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 this Bid Document to the County's satisfaction within the prescribed time. **Note: Inspection of the site is a prerequisite to be considered for award of this bid.**

Two schedules for Completion of the Work shall be considered. Each bid for completion by the specific 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 SUBCONTRACTORS

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.

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

B.03 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 **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.

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.04 PREPARING 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 ten (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.)

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 thereunder 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 substantially complete and ready for occupancy within the specific calendar days from the date the Contract Time commences to run (upon issuance of Notice to Proceed). Two bids shall be considered based on **420** calendar days and based on **300** 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 **\$3,057** 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. 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. It is the contractor's responsibility for the care of any stored materials. Any damage to or loss of said materials is the responsibility of the contractor.

C.05 PAYMENT (cont'd)

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, materialmen, 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 materialmen, 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 reinspection 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 from final acceptance by the Owner, unless otherwise specified, to be free from defects due either to faulty materials or equipment or faulty workmanship. All materials,

C.07 WARRANTY AND GUARANTEE PROVISIONS (cont'd)

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 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.08 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.09 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 readvertise 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

C.12 INDEMNIFICATION (cont'd)

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 15 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 Worker's Compensation Act or any other coverage required by the contract documents which are customarily insured under Part One of the standard Worker's 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 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)	\$ Nil
Medical Expense (Any One Person)	\$ Nil

C.14 INSURANCE (cont'd)

c. Business Auto Policy

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

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.

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

C.14 INSURANCE (cont'd)

shall be furnished by the contractor and delivered to the Purchasing Director 30 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, materialmen 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 ten (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 readvertise 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.

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 extent 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 is generally described as construction of a common influent channel and three screening channels, a storm water pond, electrical and appurtenances at the North Regional Water Reclamation Facility, and all related work as outlined in this Invitation For Bid document. Construction and record drawings are required of the successful bidder and shall fully meet the requirements of all current federal, state and county laws, rules, regulations and standards, with the most stringent applying.

D.02 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 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 (excluding Bid Form Item for Discretionary Work), shall be performed by subcontractors. Bid Form includes 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.03 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 their 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.

D.03 BIDS (cont'd)

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.04 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 expressed or implied warranty. Each bidder may, at bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies, and obtain any additional information and data which pertain to the physical conditions at or contiguous to the site 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.

D.05 PERMITS

The amount remaining as of November 3, 2008 for the remaining County permit costs is \$3,948.63.

SECTION 00300
BID FORM
(Submit in Triplicate)

For: North Regional Water Reclamation Facility Influent Structure

TOTAL BID PRICE: \$ _____ based on **completion time of 420** calendar days.

TOTAL BID PRICE: \$ _____ based on **completion time of 300** 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 Bid.

We understand that the bid 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 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: _____ Date you visited site: _____

COMPANY'S NAME: _____

AUTHORIZED SIGNATURE(S): _____

Name and Title of Above Signer(s)

CO. MAILING ADDRESS: _____

Email address: _____

TELEPHONE: () _____ FAX: () _____

Acknowledge Addendum Nos. _____ Dated: _____

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

**NORTH REGIONAL WATER RECLAMATION FACILITY
 INFLUENT STRUCTURE
 (Bid "A" - Based on Completion Time of 420 days)**

ITEM No.	DESCRIPTION	EST. QTY.	EXTENDED PRICE
1	MOBILIZATION	1 LS	\$
2	CONSTRUCTION INFLUENT STRUCTURE	1 LS	\$
3	MISCELLANEOUS WORK and CLEAN UP	1 LS	\$
4	DISCRETIONARY WORK		\$420,000.00
	TOTAL BID "A" PRICE		\$

**BID FORM - SUBCONTRACTOR PERCENTAGE
 (Bid "A" - Based on Completion Time of 420 days)**

ITEM No.	DESCRIPTION	WORK BY SUBCONTRACTOR		DESCRIPTION OF WORK BY CONTRACTOR
		%	MBEWBE	
1	MOBILIZATION			
2	CONSTRUCTION INFLUENT STRUCTURE			
3	MISCELLANEOUS WORK and CLEAN UP			

BIDDER: _____

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

**NORTH REGIONAL WATER RECLAMATION FACILITY
 INFLUENT STRUCTURE
 (Bid "B" - Based on Completion Time of 300 days)**

ITEM No.	DESCRIPTION	EST. QTY.	EXTENDED PRICE
1	MOBILIZATION	1 LS	\$
2	CONSTRUCTION INFLUENT STRUCTURE	1 LS	\$
3	MISCELLANEOUS WORK and CLEAN UP	1 LS	\$
4	DISCRETIONARY WORK		\$420,000.00
	TOTAL BID "B" PRICE		\$

**BID FORM - SUBCONTRACTOR PERCENTAGE
 (Bid "B" - Based on Completion Time of 300 days)**

ITEM No.	DESCRIPTION	WORK BY SUBCONTRACTOR		DESCRIPTION OF WORK BY CONTRACTOR
		%	MBE/WBE	
1	MOBILIZATION			
2	CONSTRUCTION INFLUENT STRUCTURE			
3	MISCELLANEOUS WORK and CLEAN UP			

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. 09-0250DC NRWRF Influent Structure.
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 the 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:

	Units of Measure	Unit Quantity	Unit Cost	Extended Cost
Trench Safety Measure (Description)	(LF, SY)			
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: _____
 STATE OF INCORPORATION, IF APPLICABLE: _____
 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:

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? Have you visited the site? _____

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?

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

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

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

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

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:

Phone: (_____) _____

SECTION 00491

Drug Free Work Place Certification

SWORN STATEMENT PURSUANT TO RESOLUTION R-01-36 SECTION 4, E (1) (a)
MANATEE COUNTY PURCHASING POLICIES, ON 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 _____, 200__ by _____.

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

Notary Public Signature My commission expires _____

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

SECTION 00491

PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES CERTIFICATION

SWORN STATEMENT PURSUANT TO ARTICLE 6,
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 judgment 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.

**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. 09-0250DC North Regional Water Reclamation Facility (NRWF) Influent Structure in strict accordance with specifications and any duly authorized subsequent addenda thereto, all of which are made a part hereof.

Article 2. ENGINEER

The County of Manatee, Project Management Division, is responsible as the OWNER and URS Corporation, 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
Project Management Division
Attn: Jeffrey Mertens, PMP, Project Manager
IFB 09-0250 / Project 6011281
1026 26th Avenue East
Bradenton, Florida, 34208
Phone: 941/708-7450

URS Corporation
Attn: Craig Osmanski, P.E.
7650 W Courtney Campbell Cswy
Tampa, Florida 33607
Phone: 813/636-2198

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 #09-0250DC
- 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. 09-0250DC North Regional Water Reclamation Facility Influent Structure), 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 \$____ 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 _____, 20____, 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 _____, 20____.

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

COUNTY OF MANATEE, FLORIDA by its
Board of County Commissioners

BY: _____
CHAIRMAN

APPLICATION FOR PAYMENT	Request No. _____ Project No. _____ Purchase Order Number: _____ County Bid No.: _____ Consultant: _____
Project: _____ From: _____ To: _____	

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 _____
TITLE

(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	UNIT	QTY	VALUE	#	CHANGE ORDERS			W.I.P. = WORK-IN-PLACE			CURRENT W.I.P.			TOTAL W.I.P.		
							QTY	+/-	+/- VAL.	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q		
<p>SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER</p>																		
TOTALS																		

ATTACH STORED-MATERIAL SCHEDULE

CONTRACT CHANGE ORDER		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: Contractor Signature: _____		THE NET CHANGE ADJUSTS THE CURRENT CONTRACT AMOUNT FROM TO	
		_____ CALENDAR DAYS ARE ADDED TO THE SCHEDULE WHICH CHANGES FINAL COMPLETION TO _____	
RECOMMENDATION, CONCURRENCES AND APPROVALS			
		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		Change Order No:	
Page 2 (Continuation)		Project Number:	
NO. OF ITEM	DESCRIPTION OF ITEM AND CHANGE	DECREASE	INCREASE
	SAMPLE SHEET ONLY OBTAIN CURRENT VERSION OF FORM FROM PROJECT MANAGER		
		DECREASE SUBTOTAL:	INCREASE SUBTOTAL:

CONTRACT CHANGE ORDER

Change Order No:

Page 3 (Continuation)

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?

DISCRETIONARY WORK - FIELD DIRECTIVE

FIELD DIRECTIVE NO:

PROJECT:

PROJECT NO.:

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

CONTRACTOR: _____
ADDRESS: _____
CITY/STATE: _____

CONTRACTOR
SIGNATURE: _____

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
CONSULTANT:	_____	_____
PROJECT ENGINEER:	_____	_____
PROJECT MANAGER:	_____	_____
SENIOR PROJECT MANAGER:	_____	_____

CERTIFICATE OF SUBSTANTIAL COMPLETION (S.C.)	CHECK ONE:	
	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>		
_____ / Date		_____ / Date
Contractor Signature		Engineer's Approval
_____		_____
Printed Name and Title		Printed Name and Title
<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	Project No.:
Address: OBTAIN CURRENT VERSION OF FORM	Warranty (months):
City/State/zip: FROM PROJECT MANAGER	

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:

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 84-02, Manatee County Procurement 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, technical specifications, terms and conditions, and the proposed contract documents (including all Addenda issued prior to receipt of bids); and becomes a part of the 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 Ordinance 08-43, Manatee County Purchasing Code.

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 Manatee County.

Should a conflict exist within the Contract Documents, the precedence in ascending order of authority is as follows: 1) Standard Printed Technical Specifications, 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 An Administrative Contract Adjustment

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 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 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 technical specifications 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 20 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 exercised 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 for 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 technical specifications 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.

END OF SECTION

TECHNICAL SPECIFICATIONS

BID SET

North Water Reclamation Facility

Influent Structure

Prepared for:

Manatee County
Project Number: 6011281

October 2008

Prepared by:

URS

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Causeway, Suite 700
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813-286-1711 Tel.
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**Manatee County
North Water Reclamation Facility
Influent Structure**

Engineers of Record

Civil Engineer:

URS Corporation

David A. Wilcox, PE
#34942

Structural Engineer:

URS Corporation

William N. Hausheer, PE
#31715

**Manatee County
North Water Reclamation Facility
Influent Structure**

Engineers of Record

Electrical Engineer:

URS Corporation

Garret S. Kerly, PE
#54952

Geotechnical Engineer:

URS Corporation

Keith Q. Giang, PE
#49510

**MANATEE COUNTY
INFLUENT STRUCTURE AT THE
NORTH WATER RECLAMATION FACILITY**

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**MANATEE COUNTY
INFLUENT STRUCTURE AT THE
NORTH WATER RECLAMATION FACILITY**

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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 or 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 the construction of a new influent structure (headworks) at the Manatee County North Water Reclamation Facility (NWRf). All the work under this contract is located in easements, rights-of-way and property owned by Manatee County
- 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 01014

CONSTRUCTION SEQUENCE

PART 1 GENERAL

1.01 DESCRIPTION

- A. Several areas of construction under this contract must be coordinated with plant personnel and accomplished in a logical order to maintain the operation of the existing headworks, RAS pump station, plant drain pump station and to allow construction to be completed within the time allowed by the Contract Documents. CONTRACTOR will also coordinate his/her activities with the other contractors, if any, to allow orderly and timely completion of all the work.
- B. When access through construction areas must be disrupted, CONTRACTOR will provide alternate acceptable access for the facility operators or other contractors or emergency services.
- C. Various interconnections within the system will depend on the closure of various valves and gates. Many of these valves and gates may not seal properly, CONTRACTOR will coordinate with the ENGINEER and with plant personnel/OWNER prior to attempting any such closure and will provide any corrective measure of temporary facilities necessary to attain the shut-off needed to perform the work at no additional cost to the OWNER and without interrupting the existing plant operation.
- D. Certain connections to existing yard piping will require the temporary shutdown of one train of the existing headworks, RAS pump station and plant drain pump station. Schedules and methods for connection to existing pipelines shall be as shown on the drawings and subject to approval of the ENGINEER and OWNER.
- E. Where water is required in large quantity for preoperational testing or other use, CONTRACTOR shall be responsible for obtaining required quantities and shall pay all fees and water usage charges except as provided below. Reclaimed water is available at the project site and may be used for testing of the new headworks at no cost to the CONTRACTOR.
- F. During Start-Up Testing, CONTRACTOR should make available the manpower, equipment and manufacturer's representatives required to make any necessary testing, adjustments and training of OWNER'S personnel. OWNER shall be responsible for delivery of potable, raw water or reclaimed water to the new headworks as necessary during Start-Up Testing.

1.02 CONSTRUCTION CONSTRAINTS

- A. The following is a list of constraints to consider in developing the overall plan of construction. This list is not intended to release the CONTRACTOR from responsibility to coordinate the work in any manner which will ensure project completion within the time allowed. The following areas are not necessarily listed in their required sequence of construction. A suggested sequence within each area, where necessary, is included.
1. The existing headworks shall remain in service until such time the new headworks construction is complete, tested and ready for normal operation.
 2. Prior to startup and testing of the new headworks, the new 48-inch influent force main shall be tied into the existing 48-inch force main just west of existing 48-inch plug valve No. 2 (See Sheet C-3).
 3. Upon successful completion of the new headworks testing requirements, the CONTRACTOR, along with plant personnel, shall isolate the east train of the existing headworks by shutting the appropriate slide gates. To minimize draining of the existing 36-inch wastewater line to Anoxic Basin No. 2, the CONTRACTOR may wish to set a sump pump in the 24-inch wastewater drop pipe (east effluent pipe at the existing headworks) and pump the raw sewage to the west train of the existing headworks. The CONTRACTOR shall then cut the existing 36-inch wastewater line to Anoxic Basin No. 2 and make the new 30-inch waste water tie into the existing 36-inch wastewater line (Cut-in No. 1, see Sheet C-4). The CONTRACTOR shall remove approximately 25 linear feet of the existing 36-inch wastewater line and permanently bulkhead the line east of the new 16-inch sanitary force main. The CONTRACTOR, along with plant personnel, shall then open existing 48-inch plug valve No. 2 and close existing 48-inch plug valve No. 3 just east of the new headworks (See Sheet C-3). The new headworks will then be in operation treating flow to existing Anoxic Basin No. 2.
 4. The CONTRACTOR shall next remove approximately 30 LF of the abandoned 36" PCCP line between the headworks and aeration basins. Prior to removing the sections, the CONTRACTOR shall pump out the line. Slide gates in the aeration basin may not completely seal. CONTRACTOR shall be prepared to handle low volumes of wastewater flow while the pipe is cut and plugged.
 5. The CONTRACTOR shall coordinate with plant personnel to shut down the existing RAS pump station and make the 16-inch RAS tie in No. 2 (Cut-In No. 2, See Sheet C-4). Permanently bulkhead the existing 16-inch RAS line just east of the new tie-in.

6. The CONTRACTOR shall coordinate with plant personnel to shut down the existing plant drain pump station and make the 16-inch sanitary force main tie-in No. 3 (Cut-In No. 3, See Sheet C-4). Permanently bulkhead the existing 16-inch force main just east of the new tie-in. At this time, all flow is going to the new headworks.
7. As stated in step 3, the CONTRACTOR may wish to set a sump pump in the western 24-inch wastewater drop pipe and pump the raw sewage to one of the existing anoxic basins or the existing sanitary manhole east of the existing headworks. The CONTRACTOR shall then cut the existing 36-inch wastewater line to Anoxic Basin No. 1 and make the new 30-inch wastewater tie-into the existing 36-inch wastewater line (Cut-In No. 4, See Sheet C-4). The CONTRACTOR shall permanently bulkhead the existing 36-inch wastewater line east of the tie-in.

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 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 24th Street, Suite 600
Pittsburgh, PA 15213

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

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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 - CONSTRUCT INFLUENT STRUCTURE COMPLETE

Payment of the lump sum price established in the Schedule of Price shall be full compensation for furnishing all labor, materials, equipment and incidentals required to complete the construction and startup of the influent treatment structure complete as specified in Divisions 1 through 17 and as shown as the Drawings, excluding those items for which measurement and payment are separately specified, as required for a full, operable and complete influent treatment structure.

Payment under this lump sum shall also include all other appurtenances and related work which are not specified or shown but are required to complete the work of the influent treatment structure item as shown on the Drawings and specified herein.

BID ITEM NO. 3 - MISCELLANEOUS WORK AND CLEANUP

Payment for all work included 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, as-builts record drawings, traffic control, rubbish and spoil removal, repair, replacement or relocation of all signs, walls, private irrigation systems and related items and any and all other items required to complete the project in accordance with Contract Documents.

BID ITEM NO. 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 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Contractor shall employ a competent photographer to take construction record photographs or perform video 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 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.
 - 2. 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 photographers numbered identification of exposure.
- G. All project photographs shall be taken from locations to adequately illustrate conditions prior to construction, or conditions of construction and state of progress. The Contractor shall consult with the Engineer at each period of photography for instructions concerning views required.

1.04 VIDEO TAPE RECORDINGS

- A. Video taping shall be done along all routes that are scheduled for construction. Video taping shall include full taping of both sides of all streets and the entire width of easements plus 10 feet on each side on which construction is to be performed. All video 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 stationing in the audio portion of the tapes for easy location identification.
- 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 televising 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.

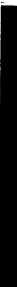
1.05 INSTRUCTION OF OWNER'S PERSONNEL

- 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

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. The cleared and grubbed surface shall be compacted to at least 98 percent of the maximum dry density as determined by AASHTO T-99 method prior to placing any fill.

SECTION 02640

VALVES AND APPURTENANCES

PART 2 PRODUCTS

Add the Following:

2.20 KNIFE GATE VALVE

- A. Valves shall be of the bonnetless knife gate type with wafer face flanged connections. Raised face flange shall be drilled to the ANSI 125/150 pound standard. Valve rating shall be 150 psi in sizes 2-inch to 24-inch and 125 psi in size 30-inch and 36-inch.
- B. Valves shall be resilient seated. Valve bodies shall be furnished with all wetted parts of type 316 stainless steel.
- C. Valve packing shall be a multiple layers of square, braided flax. The gate shall have a rounded bottom with a beveled knife edge. All sides of the gate shall be finish ground. The stem shall be stainless steel. Valve superstructure shall be fabricated carbon steel. The yoke sleeve shall be bronze. The valve body shall incorporate

guides (on sizes 6-inch and larger) and jams to assist the seating. Valves shall have a raised face seat with a relieved area around the seat to prevent jumping. Body shall have a full, round port for minimal pressure drop.

- D. Resilient seated valves shall have a seat ring with a molded resilient insert to the body and gate slides for installations where drip-tight shut-off is required.
- E. Manual activated valves 2 inches to 16 inches shall have handwheel actuators.
- F. Knife gate valves to be as manufactured by DeZurik or equal.

2.21 SOLENOID VALVES

- A. Manufacturers
 - 1. Atkomatic Valve Company, Inc., Indianapolis, Indiana
 - 2. J.D. Gould Company, Indianapolis, Indiana
 - 3. Automatic Switch Company, Florham Park, New Jersey
 - 4. Magnatrol Valve Corporation, Hawthorne, New Jersey
 - 5. Or acceptable equivalent product
- B. Screwed ends, bronze body, globe type, minimum 125-pound WOG, 2-way port, single integral seat, renewable composition disk, stainless steel internals.
- C. Class A coil, 120 volts, single phase, 60 Hertz, NEMA 4 enclosures; valve opens when energized. Valve should have manual over-ride in the event of electrical failure.

SECTION 02444 FENCING

PART 2 PRODUCTS

Add the Following:

2.06 CHAIN LINK CANTILEVER SLIDE GATES

- A. Slide gates shall be 6 foot high x 15 foot wide opening galvanized chain link cantilever slide gate. Galvanized SS40 gate roller posts shall be 4-inch outside diameter x 10 foot long. Galvanized SS40 gate latch posts shall be 3-inch outside diameter x 10 foot long. Aluminum post caps shall be 4-inch. Aluminum post caps shall be 3-inch. Stealth nylon cantilever rollers shall be 4-inch x 2.5-inch. Top and

bottom safety protective rollers shall be polyethylene. Galvanized slide gates shall have a 3-inch Mac latch to fit latch post.

- B. Gate operator shall be Model SL1000B by Hoover Fence Co.
- C. Chain link cantilever slide gates and operators shall be by Hoover Fence Co. or equal.

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 (NESHA), 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

1

2

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 98 percent in accordance with ASTM test 1557-70T, Method A or C.

END OF SECTION



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

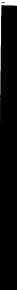
3.01 EXCAVATION AND DRAINAGE

- 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.

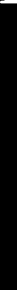
3.02 PLACING TOPSOIL

- 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 02355

LUMBER LEFT IN PLACE

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish and install shoring and sheeting as necessary to provide adequate safety.

PART 2 PRODUCTS

2.01 MATERIALS

Wood for shoring and sheeting shall be green, rough cut hardwood planking.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor shall furnish, install and maintain sheeting and bracing required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below which is necessary for proper construction and to protect adjacent structures from undermining or other damage. If the Engineer determines that insufficient or improper supports have been provided, he may order additional supports to be installed at the expense of the Contractor. Compliance with such orders shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting. Should voids form, they shall be immediately filled and rammed.
- B. The Contractor shall embed and leave in place all sheeting, bracing and other related items as shown on the Contract Drawings. The Owner/Engineer may direct that sheeting and bracing timber be cut off at a specified elevation. No additional payment or compensation shall be made for this work.
- C. Sheeting and bracing not left in place shall be removed carefully in such manner as not to endanger other structures, utilities, property, or proposed

construction.

- D. The Owner/Engineer may order sheeting and bracing to be left in place; however, this shall not relieve the Contractor from liability for damages to persons or property due to negligence or the failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
- E. The Contractor shall receive no payment other than that included in the pipe bid item price for any timber used for sheeting bracing, or other related items.

END OF SECTION

SECTION 02430

STORM DRAINAGE STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to install the drainage pipe, precast concrete manholes, headwalls, and appurtenances as specified herein and shown on the Contract Drawings or called out in the Contract Documents.
- B. All drainage structures shall be manufactured and installed in accordance with details included herein, and as shown on the Drawings.

1.02 QUALIFICATIONS

All precast structures shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of items to be furnished. The structures shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Contract Documents and the Florida Department of Transportation Specifications for Road and Bridge Construction, latest edition.

1.03 SUBMITTALS

Contractor shall submit to the Engineer for approval, shop drawings showing details of construction, reinforcing, joints, and pipe/wall connections as specified in the Contract Documents.

1.04 INSPECTION

- A. The quality of all materials, the process of manufacture, and the finished sections of pipe and structures shall be subject to inspection and approval by the Owner/Engineer, or other authorized representative. Such inspection may be made at the place of manufacture, or at the work site or both places. Sections shall be subject to rejection at any time due to the failure to meet any of the Contract requirements, even if a sample section may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed immediately from the site. All sections which have been

damaged after delivery will be rejected. If a damaged section is installed, it shall be removed and replaced at the Contractor's expense.

- B. At the time of inspection, the sections shall be carefully examined for compliance with the applicable ASTM Standards, Contract Documents, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, crack, roughness, soundness, and other features. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS AND DESIGN

- A. Precast structures shall conform to ASTM Designation C478 and C789 or C850 and meet the following additional requirements:
 - 1. Type II cement shall be used except as otherwise approved.
 - 2. Holes to accommodate pipe and structures shall be precast into the section at the manufacturer's plant.
 - 3. All sections shall be cured by an approved method and shall not be shipped or manhole rungs subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 6 days after fabrication and/or repair, whichever is longer.
 - 4. Precast concrete top slabs shall be designed for an AASHTO H-20 wheel loading.
 - 5. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast unit.

6. Minimum wall thickness for structures and manholes shall be 8 inches.
 7. The minimum inside diameter for manholes shall be 48 inches.
 8. The precast reinforced base shall be a minimum of 8 inches thick and be cast monolithically with the bottom section of manhole walls.
 9. Manhole sections shall be a tongue and groove joint complete with flexible rubber "O" ring gasket. The O-ring type joint shall be round compression ring of butyl material set in annular spaces cast into the tongue and groove type joint. The ring shall be uniformly compressed between the positioned sections so as to form a watertight joint. After the sections are assembled, the remaining space in the joint shall be pointed up and filled with a dense cement mortar and finished so as to make a smooth, continuous surface inside and outside the wall sections. "O" ring gaskets shall meet ASTM C443 requirements.
 10. The Engineer shall require the precast sections to be tested by a certified testing laboratory if he deems the precast sections are not in compliance with the Contract Documents.
- B. Pipe outlets larger than six (6) inch diameters are to be precast. A minimum clearance of six (6) inches is to remain between the outlets for adjacent pipe in any single manhole section. A minimum of two (2) reinforcing bars shall remain in the wall between any two (2) outlets.
- C. The Contractor shall furnish the height of structure, the alignment angle and size of all pipes entering manhole to the Manufacturer.
- D. Base sections shall have sufficient clearance to allow a minimum wall of six (6) inches between top of highest outlet and the bottom of joint.
- E. Pipes shall extend a minimum of four (4) inches into structure wall, but shall not extend beyond the interior wall.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Manholes shall be installed to meet or exceed the requirements of the State of Florida Department of Transportation and the Contract Documents.
- B. Precast concrete sections shall be set 1/4-inch maximum vertical alignment. The outside and side joint shall be filled with a dry mortar consisting of one (1) part cement and two (2) parts sand. The joints shall be finished flush with the adjoining surfaces and allowed to set for 24 hours before backfilling. Backfilling operations shall carefully fill up evenly on all sides. Leaks inside the manhole shall be caulked with lead wool to the satisfaction of the Engineer. The Contractor shall install the precast sections in a manner that will result in a watertight joint.
- C. Upon authorization of the Owner/Engineer, concrete pipe section repairs shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- D. Field cutting of pipe outlets require prior authorization of the Owner/Engineer. Cutting shall be done prior to setting sections in place to prevent jarring or movement of the mortar joints.
- E. As directed by the Engineer the precast concrete base shall be placed on a bed of crushed limerock and shall provide even bearing and grade control.
- F. Manhole and Head Wall Pipe Connections

A beveled outlet is acceptable if it is filled with non-shrink waterproof grout after the pipe is inserted and provided the grout completely fills all the space surrounding the pipe. Concrete encasement around the stubs is required if this method is used.
- G. Cast iron frames furnished and installed shall be placed, shimmed and set in portland cement mortar to the required grade as per the Contract Documents.
- H. Pipes entering the manhole shall be constructed to the grades shown on the Drawings.
- I. Outer surfaces of precast and cast-in-place manholes shall receive two (2) coats of bituminous dampproofing at a rate of 30-60 square feet per gallon or as directed by

the Engineer and must be in accordance with the manufacturer's instructions.

- J. Manhole frames and covers shall be set to grade from the top of the structure with brick.
- K. All manholes and cast-in-place structures shall be watertight. Leaks shall be corrected to the satisfaction of the Engineer.
- L. Manholes shall be provided with stubs and plugs as indicated on the Contract Drawings or specified in the Contract Documents. Pipe stubs shall be provided with suitable caps.

END OF SECTION

SECTION 02444

FENCING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, material, equipment and incidentals necessary for complete installation of chain link fence systems. The fencing shall be installed according to manufacturer's specifications unless otherwise directed or authorized by the Owner/Engineer.
- B. The Contractor's security fencing is at his expense and option and is not covered in this Section.

1.02 QUALITY ASSURANCE

- A. Standards of Manufacture
 - 1. Standards of manufacture shall comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and as herein specified.
- B. Provide each type of steel fence and gates as a complete unit produced by a single manufacturer, including, but not limited to accessories, fittings, fasteners and appurtenances complete and ready for use.
- C. Acceptable Manufacturers:
 - 1. Anchor
 - 2. Cyclone
 - 3. or approved equal
- D. Erector Qualifications: The Contractor or approved subcontractor, must have a minimum of two years experience in similar fence installation.

1.03 SUBMITTALS

- A. Product Data: Steel Fences and Gates
 - 1. The Contractor shall submit for review and approval to the Owner/Engineer, eight copies of the manufacturer's technical data, details of fabrication, installation instructions and

procedures for steel fences and gates. The Contractor shall be responsible for a copy of each instruction to be given to the Installer.

B. Samples:

1. The Contractor shall submit three samples approximate size 6-inches long, or 6-inches square of fabric material, framework members and typical accessories to the Owner/Engineer for review and approval.

C. Certificates:

1. The Contractor shall provide manufacturer's certification that materials meet or exceed the Contract Document requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. The pipe sizes indicated are commercial pipe sizes.
- B. The tube sizes indicated are nominal outside dimension.
- C. Framework and appurtenances shall be finished with not less than minimum weight of zinc per sq. ft. and shall comply with the following:
 1. Pipe: ASTM A53 (1.8 oz. zinc psf)
 2. Square tubing: ASTM A 123 (2.0 oz. zinc psf)
 3. Hardware and Accessories: ASTM A 153 (zinc weight per Table I).
- D. All fence components shall be galvanically compatible.

2.02 FABRIC

- A. Fabric shall be 0.148 inch (9 gage) steel wire, 2-inch diamond mesh and both top and bottom salvages shall be twisted and barbed for fabric over 60-inches high. Finish shall be hot dipped galvanized, ASTM A 392, Class II.

2.03 POSTS, RAILS AND BRACES

- A. End, Corner and Pull Posts:
 1. The Contractor shall furnish end, corner and pull posts of the minimum size and weight as follows:

- a. Up to 5 foot fabric height
 - (1) 2.375-inch OD pipe weighing 3.65 pounds per linear ft.
 - (2) 2.50-inch square tubing weighing 5.59 pounds per linear foot.
- b. Over 5 foot fabric height
 - (1) 2.875-inch OD pipe weighing 5.79 pounds per linear foot.
 - (2) 2.50-inch square tubing weighing 5.59 lbs. per linear foot.

B. Line Post:

- 1. The Contractor shall furnish line posts of the minimum sizes and weight as follows. Post shall be spaced 10 foot o.c. maximum, unless otherwise indicated:
 - a. Up to 5 foot fabric height.
 - (1) 1.90-inch OD pipe weighing 2.72 pounds per linear foot.
 - b. Over 5 foot fabric height.
 - (1) 2.375-inch OD pipe weighing 3.65 pounds per linear foot.

C. Gate Posts:

- 1. The Contractor shall furnish gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
 - a. Up to 6 feet wide.
 - (1) 2.875-inch OD pipe weighing 5.79 pounds per linear foot.
 - (2) 2-1/2 inch square tubing weighing 5.59 pounds per linear foot.
 - b. Over 6 feet and up to 13 feet wide.
 - (1) 4-inch OD pipe weighing 9.11 pounds per linear foot.
 - c. Over 13 feet and up to 18 feet wide.
 - (1) 6.625 inches OD weighing 18.97 pounds per linear foot.
 - d. Over 18 feet.

(1) 8.625 inches OD weighing 28.55 pounds per linear foot.

D. Top Rails:

1. The Contractor shall furnish the following top rails unless otherwise indicated:
 - a. 1.660-inch OD pipe weighing 2.27 pounds per linear foot.

E. Post Brace Assembly:

1. The Contractor shall furnish bracing assemblies at the end, gate, at both sides of corner and pull posts, with the horizontal brace located at mid-height of the fabric.
2. Use 1.660-inch OD pipe weighing 2.27 pounds per linear foot for horizontal brace and 3/8-inch diameter rod with turnbuckles for diagonal truss.

F. Tension Wire:

1. The Contractor shall furnish tension wire consisting of galvanized 0.177 inch (7 gage) coiled spring wire as per ASTM A824 at the bottom of the fabric only.

G. Barbed Wire Supporting Arms:

1. The Contractor shall furnish pressed steel, wrought iron, or malleable iron barbed wire supporting arms, complete with provisions for anchorage to posts and attaching three rows of barbed wire to each arm. Supporting arms may be attached either to posts or integral with post top weather cap. The Contractor shall provide a single 45 degree arm for each post where indicated.

H. Barbed Wire:

1. The Contractor shall furnish barbed wire. It shall be 2 strand, 12-1/2 gauge wire with 14 gauge, 4-point barbs spaced 5-inch o.c., galvanized, complying with ASTM A121, Class 3.

I. Post Tops:

1. The Contractor shall furnish post tops. Tops shall be pressed steel, wrought iron, or malleable iron

of ASTM F626 designed as a weathertight closure cap (for tubular posts). The Contractor shall furnish one cap for each post unless equal protection is afforded by a combination of post top cap and barbed wire supporting arm. The Contractor shall furnish caps with openings to permit through passage of the top rail.

J. Stretcher Bars:

1. The Contractor shall furnish stretcher bars. Bars shall be one piece lengths equal to the full height of the fabric, with a minimum cross-section of 3/16-inch x 3/4-inch. The Contractor shall provide one stretcher bar for each gate and end post and two bars for each corner and pull post, except where fabric is integrally woven into the post.

K. Stretcher Bar Bands:

1. The Contractor shall furnish stretcher bar bands. Bands shall be steel, wrought iron, or malleable iron, a maximum space of 15-inch o.c. to secure stretcher bars to end, corner, pull and gate posts.

2.04 GATES

A. The Contractor shall provide fabricated gate perimeter frames of tubular members. Additional horizontal and vertical members shall ensure proper gate operation and attachment of fabric, hardware and accessories. The maximum space of the frame members shall not be more than 8-inches apart. Fabrication is as follows:

1. Up to 5 feet high, or leaf width 8 feet or less.
 - a. 1.660-inch OD pipe weighing 2.27 pounds per linear foot.
 - b. 1.5 inch sq. tubing weighing 2.27 pounds per linear foot.
2. Over 5 feet high, or leaf width exceeding 8 feet.
 - a. 1.90 inch OD pipe weighing 2.72 pounds per linear foot.
 - b. 2-inch square tubing weighing 2.60 pounds per linear foot.

B. The Contractor shall assemble gate frames by welding or with special malleable or pressed steel fittings and rivets for rigid connections. He shall use the same fabric width as for the fence, unless otherwise indicated in the Contract Documents or authorized by the

Owner/Engineer. He shall install the fabric with stretcher bars at vertical edges. The bars may also be used at the top and bottom edges. The contractor shall attach stretchers to the gate frame at a maximum spacing of 15-inch o.c. He shall attach the hardware with rivets or by other means which will prevent removal or breakage.

C. The Contractor shall install diagonal cross-bracing consisting of 3/8-inch diameter adjustable length truss rods on gates as necessary to ensure frame rigidity without sag or twist.

D. The Contractor shall install barbed wire above the gates. He shall extend the end members of gate frames 12-inches above the top member which will be prepared for three strands of wire. The Contractor shall provide necessary clips for securing wire to extensions.

E. Gate Hardware:

1. The Contractor shall furnish the following hardware and accessories for each gate.

a. Hinges: Pressed or forged steel or malleable iron to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over six feet nominal height.

b. Latch: Forked type of plunger-bar type to permit operation from either side of gate with padlock eye as integral part of latch.

c. Keeper: Provide keeper for all vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.

d. Double Gates: Provide gate stops for double gates, consisting of mushroom type of flush plate with anchors. Set in concrete to engage the center drip drop rod or plunger bar. Include locking device and padlock eyes as an integral part of the latch, using one padlock for locking both gate leaves.

e. Padlocks and Keys: One (1) solid brass padlock for each gate, with six (6) keys shall be furnished for each gate called for. Locks shall be keyed to the Owner's Master Keying

System.

- f. Where gates are between masonry piers, provide "J" with 4-inch square anchor plate to masonry contractor for building in.

2.05 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Wire Ties:

1. The Contractor shall tie fabric to line posts. He shall use 9 gauge wire ties spaced 12-inches o.c. For tying fabric to rails and braces, he shall use 9 gauge wire ties spaced 24-inches o.c. For tying fabric to tension wire, he shall use 11 gauge hog rings spaced 24-inches o.c. The finish of ties shall match the fabric finish.

B. Concrete:

1. The Contractor shall provide portland cement concrete in compliance with ASTM C-150 and the Contract Documents. Aggregates shall comply with ASTM C-33. The Contractor shall mix the materials to obtain a minimum 28-day compressive strength of 2500 psi, using a minimum of 4 sacks of cement per cubic yard, a maximum size aggregate of 1-inch, a maximum 3-inch slump and air entrainment of 2 percent to 4 percent.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The Contractor shall not start the fence installation prior to the final grade completion, and the finish elevations established, unless otherwise authorized by the Owner/Engineer.

B. Excavation:

1. For post footings, the Contractor shall drill holes in firm, undisturbed or compacted soil of the diameters and spacings shown or called out in the Contract Documents.
 - a. For holes not shown or called out on the Contract Documents, the Contractor shall excavate minimum diameters recommended by the fence manufacturer.

- b. Post holes shall be in true alignment and of sufficient size to provide a permanent concrete foundation. Concrete shall be poured against undisturbed earth sides and bottom. All holes shall be 48-inches deep with posts and corner posts placed in the concrete to a depth of 36-inches. The gate posts shall be set in the concrete to a depth of 42-inches below the surface in firm, undisturbed soil. Holes shall be well centered on the posts. A minimum diameter of 12-inches shall be required for all post holes.
- c. Excavated soil shall be removed from the Owner's property.
- d. If solid rock is encountered near the surface, the Contractor shall drill into rock at least 12-inches for line posts and at least 18-inches for end, pull, corner or gate posts. Hole shall be drilled to at least 1-inch greater diameter than the largest dimension of the post to be placed.
- e. If the Contractor encounters solid rock below solid overburden, he shall drill to the full depth required; however, rock penetration need not exceed the minimum depths specified.

C. Setting Posts:

- 1. The Contractor shall remove loose and foreign materials from the sides and bottoms of holes, and moisten soil prior to placing concrete.
 - a. Center and align posts in holes 3-inches above bottom of excavation.
 - b. Place concrete around posts in a continuous pour and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations. The top of concrete shall extend 2-inches above finish grade.
 - c. Trowel finish tops of footings and slope or dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.

- d. Keep exposed concrete surfaces moist for at least 7 days after placement, or cure with membrane curing materials, or other acceptable curing method.
- e. Grout-in posts set into sleeved holes, concrete constructions, or rock excavations with non-shrink portland cement grout, or other acceptable grouting material.

D. Concrete Strength:

The Contractor shall allow the concrete to attain at least 75% of its minimum 28-day compressive strength no sooner than 7 days after placement, before rails, tension wires, barbed wire, or fabric is installed. The Contractor shall not stretch and tension fabric or wires and shall not hang gates until the concrete has attained its full design strength.

E. Top Rails:

The Contractor shall run the rail continuously through post caps or extension arms and bend to radius for curved runs. He shall provide expansion coupling as recommended by fencing manufacturer.

F. Brace Assemblies:

The Contractor shall install braces so that posts are plumb when diagonal rod is under proper tension.

G. Tension Wire:

The Contractor shall install tension wires by weaving through the fabric and tying to each post with not less than 0.170 inch galvanized wire, or by securing the wire to the fabric.

H. Fabric:

The Contractor shall leave approximately 3-inches between finish grade and bottom salvage, except where the bottom of the fabric extends into the concrete. He shall pull the fabric taut and tie it to posts, rails and tension wires. He shall install fabric on the security side of the fence and anchor it to the framework so that the fabric remains in tension after the pulling force is released.

I. The Contractor shall repair damaged coatings in the shop or in the field by recoating utilizing manufacturer's recommended repair compounds and as applied per manufacturer's recommendations.

J. Stretcher Bars:

The Contractor shall thread through or clamp the bars to the fabric 4-inches o.c. and secure them to posts with metal bands spaced 15-inches o.c.

K. Barbed Wire:

The Contractor shall install 3 parallel wires on each extension arm on the security side of fence, unless otherwise indicated. He shall pull the wire taut and fasten securely to each extension arm.

L. Gate:

The Contractor shall install gates plumb, level and secure for full opening without interference. He shall install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. He shall adjust hardware for smooth operation and lubricate where necessary.

M. Tie Wires:

The Contractor shall use U-shaped wire, conforming to the diameter of the attached pipe, and shall clasp the pipe and fabric firmly with twisted ends of at least 2 full turns. He shall bend the end of the wire to minimize hazard to persons or clothing.

N. Fasteners:

The Contractor shall install nuts for tension band and hardware bolts on the side of fence opposite the fabric side. Pen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION

SECTION 02480

LANDSCAPING

PART 1 GENERAL

1.10 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to install trees, ground cover, and shrubs, to place accessory planting materials, to maintain and guarantee all planted areas. All work shall be in strict accordance with sound nursery practice and shall include maintenance and watering of all of the work of this Contract until final completion and acceptance by the Owner.
- B. The landscaping shall be performed by a contractor or subcontractor who specializes in landscaping and who is fully familiar and experienced in projects of this type and scope. The landscaping contractor or subcontractor shall be subject to the approval of the Engineer.
- C. The Contractor shall provide all landscaping complete and ready for use as specified in the Contract Documents and as shown on the Drawings.

1.02 SUBMITTALS

- A. The Contractor shall submit to the Owner/Engineer for review and approval, shop drawings and complete written maintenance instructions for each type of plant furnished under this Contract.
- B. The Contractor shall submit representative samples of any or all of required accessory planting materials as requested by the Owner/Engineer.

1.03 OBSTRUCTIONS BELOW GROUND

- A. The Owner/Engineer may change the location of plant material if underground construction, utilities or obstructions are encountered in excavation of planting areas or pits.
- B. The Contractor shall make such changes without additional compensation from the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Plant species and size shall conform to those indicated in the Plant List and in plan locations shown on the Drawings. Nomenclature shall conform to the Florida Department of Agriculture: "Grades and Standards for Nursery Plants". The designated authority for identification of plants shall be in conformance with FDOT Standard Specification Section 580-2.1.1 Plants.
- B. Plants shall be sound, healthy, vigorous, free from plant diseases, insects, pests, or their eggs and shall have healthy normal root systems. Plants shall be nursery grown stock, freshly dug. No heeled in, cold storage, or collected stock shall be accepted.
- C. Shape and Form
 - 1. Plant material shall be symmetrical, typical for the variety and species, and shall conform to the measurements specified in the Plant List.
 - 2. Plants used where symmetry is required shall be matched as nearly as possible.
 - 3. Plants shall not be pruned prior to delivery except as authorized by the Owner/Engineer.
 - 4. All plants shall have been transplanted or root pruned at least once in the past three years.
 - 5. Unless otherwise noted, street trees shall be free of branches up to six feet, with the single leader well branched, and with straight trunks.
 - 6. Shrubs shall have been transplanted twice, have fully developed root systems, be heavily canned with foliage to base, fulfill dimensions required, and be typical of species.
 - 7. Ground covers shall have sturdy fibrous root systems and shall be heavily leafed.
- D. Measurement: The height and/or width of trees shall be measured from the ground or across the normal spread of branches with the plants in their normal position. This measurement shall not include the immediate terminal growth.
- E. Substitutions in plant species or size shall be made only with the written approval of the Engineer.
- F. Ground cover plants shall be planted in beds of four inches of approved topsoil. The beds shall be thoroughly disked into the soil. The compacted and settled finished

surface shall be set to the required grade. Plants shall be spaced as described in the Contract Documents or shown on the Contract Drawings, or otherwise directed by the Owner/Engineer and in accordance with the best practices of the trade.

G. Planting Soil

1. Soil for backfilling around plants and planting beds shall be a good grade of garden loam as approved by the Owner/Engineer. Soil shall be free of heavy clay, coarse sand, stones, lumps, sticks, or other foreign material. The soil shall not be delivered or used in a muddy condition.
2. The soil shall be taken from ground that has never been stripped. There shall be a slight acid reaction to the soil with no excess of calcium or carbonate. The soil shall be free from excess weeds or other objectionable material.
3. Soil for trees and shrubs shall be delivered in a loose, friable condition. All trees shall average approximately one cubic yard per tree, except Sabal Palmetto, which shall be planted with clean sand. There shall be a minimum of 4-inches of planting soil in ground cover areas and 1/8 cubic yard per shrub or vine.
4. No marl shall be allowed in ground cover planting beds.

H. Before plants are backfilled with planting soil, fertilizer tablets, Agriform 20-10-5 or equal, shall be placed in each pit. The Contractor shall provide three tablets for each tree and one for each shrub or vine.

I. Tree Staking: All tree staking and bracing shall be included herein in accordance with sound nursery practice and shall be in accordance with the Contract Documents. The Contractor shall furnish all materials required for staking and bracing as approved.

J. Landscaping stones shall be inert and nonleaching. The Contractor shall provide physical samples for approval prior to installation. Crushed limerock shall not be acceptable.

PART 3 EXECUTION

3.01 PLANTING PROCEDURES

A. Plant Locations: All plants shall be located as shown on the Drawings, to dimensions if shown, to scale if not dimensioned. Large areas or beds shall be scaled and the plants spaced evenly. Approval by the Engineer is

required before any plants may be installed.

B. Tree Pits: Pits for trees shall be at least two feet greater in diameter than the specified diameter of the ball. Pits shall be of sufficient depth to allow a 12-inch layer of planting soil under the ball when it is set to grade. Bottom of pit shall be loosened prior to backfilling.

C. Digging and Handling

1. Plants shall be handled at all times so that roots or balls are adequately protected from sun or drying winds. Tops or roots of plant allowed to dry out will be rejected.
2. Balled and burlapped plants shall be moved with firm, natural balls of soil, not less than one foot diameter of ball to every one inch caliper of trunk, and a depth of not less than $\frac{2}{3}$ of ball diameter. No plant shall be accepted when the ball of earth surrounding its roots has been cracked or broken. All trees, except palms, shall be dug with ball and burlapped. Root pruning shall have been done at minimum of four weeks before planting at the job.
3. Bare root plants shall be dug with spread of root and of sufficient depth to insure full recovery of plant.

D. Cabbage Palms (Sable Palmetto):

1. Cabbage Palms shall be taken from moist black sand areas. Only a minimum of fronds shall be removed from the crown to facilitate moving and handling. Clear trunk or overall height shall be as specified after the minimum of fronds have been removed.
2. Cabbage Palms buds shall be tied to a suitable support with a burlap strip, to be left in place until the tree is well established in its new location.
3. Cabbage Palms shall be planted in sand, thoroughly washed in during planting operations, and with a dished or saucer depression left at the soil line for future waterings. Palms with marred or burned trunks will be accepted at the discretion of the Engineer only.
4. Trees moved by winch or crane shall be thoroughly protected from chain marks, girdling or bark slippage by means of burlap, wood battens, or other approved method.

E. When balled or burlapped plants are set, planting soil shall be carefully tamped under and around the base of

the balls to prevent voids. All burlap, rope, wires, etc., shall be removed from the sides and tops of balls, but no burlap shall be pulled from underneath. Roots of bare rooted plants shall be properly spread out and planting soil carefully worked in among them.

- F. All plants shall be set straight or plumb, in locations shown on the Drawings. Except as otherwise specified, plants shall be planted in pits which shall be set at such level that, after settlement, they bear the same relation to the finished grade or the surrounding ground as they bore to the grade of the soil from which they are taken.
- G. Pruning shall be carefully done by experienced plantsmen. Prune immediately upon acceptance by the Owner, including any broken branches, thinning small branches and tipping back main branches (except main leaders).
- H. Excess soil and debris shall be disposed of off the project site unless ordered stockpiled by the Engineer.

3.02 NORMAL MAINTENANCE OF PLANT MATERIALS

- A. Plant material maintenance shall begin when planting operations start and shall extend until final acceptance of work.
- B. Maintain all plant materials under this Contract to the satisfaction of the Engineer. Maintenance shall include necessary watering, cultivation, weeding, pruning, spraying, tightening and repair to guy wires, removal of dead material, resetting, and other work required to conform with referenced standards and accepted nursery standards as approved.
- C. Plant materials which are in a tilted or in a leaning position shall be properly righted.
- D. After final acceptance by the Owner and until one calendar year after acceptance of all plantings, the landscaping contractor or subcontractor shall make monthly inspections of materials and report in writing to the Engineer the conditions of the plants and the necessary requirements to keep the plants in a healthy growing condition.

3.03 TREE AND PLANT PROTECTION

- A. The Contractor shall remove all trees (if any) within the limit of landscaping shown on the detail sheet except those designated to be salvaged (if any). Prior to removal of said trees, the Contractor shall obtain a tree removal permit, if required. All other trees in the

vicinity of the work shall be protected against damage by the Contractor until all work under the Contract has been completed.

- B. Consult with the Engineer, and remove agreed-on roots and branches which interfere with construction.
 - 1. Employ qualified tree surgeon to remove, and to treat cuts.
- C. Provide temporary barriers to a height of six feet around each group of trees and plants.
- D. Protect root zones of trees and plants
 - 1. Do not allow vehicular traffic or parking.
 - 2. Do not store materials or products.
 - 3. Prevent dumping or refuse or chemically injurious materials or liquids.
 - 4. Prevent puddling or continuous running water.
- E. Carefully supervise excavating, grading, and filling, and subsequent construction operations, to prevent damage.
- F. In case of inadvertent damage to any tree or plant by the Contractor or any of his subcontractors or employees, the Contractor shall provide replacement of each such damaged tree or plant with a new one of acceptable type, size and quality.
- G. Completely remove barricades, including foundations, when construction has progressed to the point that they are no longer needed, and when approved by the Engineer.
- H. Clean and repair damage caused by installation, fill and grade the areas of the site to required elevations and slopes, and clean the area.

3.04 GUARANTEE

The life and satisfactory condition of all plant material planted shall be guaranteed by the Contractor for a minimum of one calendar year. Guarantee shall include complete replacement with material of the same kind and size as in the original work if not in a healthy condition, as determined by the Engineer, at the end of the guarantee period.

3.05 REPLACEMENT

- A. At the end of the guarantee period, any plant required under this Contract that is dead or not in satisfactory growth as determined by the Engineer, shall be removed. Plants replaced shall be guaranteed for 90 days after

date of replacement.

- B. Replacement of plants necessary during guarantee period shall be the responsibility of the Contractor, except for possible replacements of plants resulting from removal, vandalism, acts of neglect on the part of others, or acts of God.
- C. All replacements shall be plants of the same kind and size as specified in the Drawings. They shall be furnished and planted as herein specified. The cost shall be the responsibility of the Contractor.

END OF SECTION



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 02513

ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials and equipment necessary to complete all milling asphalt pavement and asphalt concrete paving as called out on the Contract Documents or as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. Qualifications of Asphalt Concrete Producer: The only materials permitted shall be furnished by a bulk asphalt concrete producer exclusively engaged in the production of hot-mix, hot-laid asphalt concrete.
- B. Qualification of Testing Agency: The Owner may employ a commercial testing laboratory to conduct tests and evaluations of asphalt concrete materials and design. The Contractor shall:
 - 1. Provide asphalt concrete testing and inspection service acceptable to Engineer.
 - 2. Include sampling and testing asphalt concrete materials proposed, and tests and calculations for asphalt concrete mixtures.
 - 3. Provide field testing facilities for quality control testing during paving operations.
- C. Requirements of Regulatory Agencies: The Contractor shall comply with the applicable requirements of:
 - 1. Manatee County Utility Operations Department
 - 2. Manatee County Transportation Department
 - 3. State of Florida Dept. of Transportation

1.03 PAVING QUALITY REQUIREMENTS

- A. General: In addition to other specified conditions, the Contractor shall comply with the following minimum requirements:
 - 1. In-place asphalt concrete course shall be tested for compliance with requirements for density, thickness and surface smoothness.
 - 2. Final surface shall be provided of uniform texture, conforming to required grades and cross sections.
 - 3. A minimum of four inch diameter pavement specimens for each completed course shall be taken from

- locations as directed by the Engineer.
4. Holes from test specimens shall be repaved as specified for patching defective work.

B. Density:

1. When subjected to 50 blows of standard Marshall hammer on each side of an in place material specimen, densities shall be comparable to a laboratory specimen of same asphalt concrete mixture.
2. The minimum acceptable density of in-place course material shall be 98% of the recorded laboratory specimen density.

C. Thickness: In-place compacted thicknesses shall not be acceptable if less than the minimum thicknesses shown on the Drawings.

D. Surface Smoothness:

1. Finished surface of each asphalt concrete course shall be tested for smoothness, using a 10 ft. straightedge applied parallel to and at right angles to centerline of paved areas.
2. Surface areas shall be checked at intervals directed by Engineer.
3. Surfaces shall not be acceptable if they exceed the following:
 - a. Base Course: 1/4 in. in 10 ft.
 - b. Surface Course: 3/16 in. in 10 ft.
 - c. Crowned Surfaces:
 - (1) Test crowned surfaces with a crown template, centered and at right angles to the crown.
 - (2) Surfaces will not be acceptable if varying more than 1/4 in. from the template.

1.04 SUBMITTALS

- A. Samples: The Contractor shall provide samples of materials for laboratory testing and job-mix design.
- B. Test Reports: The Contractor shall submit laboratory reports for following materials tests:
 1. Coarse and fine aggregates from each material source and each required grading:
 - a. Sieve Analysis: ASTM C 136 (AASHTO T 27).
 - b. Unit Weight of Slag: ASTM C29 (AASHTO T 19).

- c. Soundness: ASTM C 88 (AASHO T 104) for surface course aggregates only.
 - d. Sand Equivalent: ASTM D 2419 (AASHO T 176).
 - e. Abrasion of Coarse Aggregate: ASTM C131 (AASHO T 96), for surface course aggregates only.
2. Asphalt cement for each penetration grade:
- a. Penetration: ASTM D5 (AASHO T49).
 - b. Viscosity (Kinematic): ASTM D2170 (AASHO T 201).
 - c. Flash Point: ASTM D92 (AASHO T 48).
 - d. Ductility: ASTM D 113 (AASHO T 51).
 - e. Solubility: ASTM D 4 (AASHO T 44).
 - f. Specific Gravity: ASTM D 70 (AASHO T 43).
3. Job-mix design mixtures for each material or grade:
- a. Bulk Specific Gravity for Coarse Aggregate: ASTM C 117(AASHO T 85).
 - b. Bulk Specific Gravity for Fine Aggregate: ASTM C 128(AASHO T 84).
4. Uncompacted asphalt concrete mix: Maximum Specific Gravity: ASTM D 2041 (AASHO T 209).
5. Compacted asphalt concrete mix:
- a. Bulk Density: ASTM D 1188 (AASHO T 166).
 - b. Marshall Stability and Flow: ASTM D 1559.
6. Density and voids analysis:
- a. Provide each series of asphalt concrete mixture test specimens, in accordance with A.I. MS-2 "Mix Design Methods for Asphalt Concrete".
 - b. Use Marshall method of mix design unless otherwise directed or acceptable to the Engineer.
 - c. Report the quantity of absorbed asphalt cement in pounds of dry aggregate, percent air voids, and percent voids in mineral aggregate.
7. Sampling and testing of asphalt concrete mixtures for quality control during paving operations:
- a. Uncompacted asphalt concrete mix.
 - (1) Asphalt Cement Content: ASTM D 2172 (AASHO T 164).
 - (2) Penetration of Recovered Asphalt Cement: ASTM D 5(AASHO T 49).

- (3) Ductibility of Recovered Asphalt Cement:
ASTM D 113(AASHO T 51).
- b. Compacted asphalt concrete mix:
 - (1) Bulk Density: ASTM D 1188 (AASHO T 166).
 - (2) Marshall Stability and Flow: ASTM D 1559).
- c. Perform at least one test for each day's paving.
- 8. Asphalt plant inspection: ASTM D 290.
- 9. Additional testing:
 - a. Retesting shall be required if previous tests indicate insufficient values, or if directed by the Engineer.
 - b. Testing shall continue until specified values have been attained.
- 10. Asphalt concrete materials which do not comply with specified requirements shall not be permitted in the work.

1.05 JOB CONDITIONS

- A. Weather Limitations:
 - 1. Apply bituminous prime and tack coats only when the ambient temperature in the shade is 50 degrees F. and when the temperature has not been below 35 degrees F. for 12 hours immediately prior to application.
 - 2. Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.
 - 3. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.
 - 4. Base course may be placed when air temperature is not below 30 degrees F. and rising, when acceptable to the Engineer.
- B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.
- C. Traffic Control:
 - 1. Maintain vehicular and pedestrian traffic during

paving operations, as required for other construction activities.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Soil Cement Base Course: as specified in FDOT Section 270, "Material for Base and Stabilized Base", and as called for in the Contract Documents.
- B. Aggregate for Asphalt Concrete, General:
 - 1. Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D 692.
 - 2. Sand, stone, or slag screening: ASTM D 1073.
 - 3. Provide aggregate in gradations for various courses to comply with local highway standards.
- C. Surface Course Aggregates:
 - 1. Provide natural sand, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions.
- D. Asphalt Cement: Comply with ASTM D 946 for 85-100 penetration grade.
- E. Prime Coat:
 - 1. Cut-back liquid asphalt.
 - 2. Medium-Curing type: ASTM D 2027, Grade MC-70.

2.02 ASPHALT-AGGREGATE MIXTURES

- A. Job-mix criteria:
 - 1. Provide job-mix formulas for each required asphalt-aggregate mixture.
 - 2. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.
 - 3. Comply with the mix requirements of local governing highway standards.
 - 4. Maintain material quantities within allowable tolerances of the governing standards.

2.03 TRAFFIC AND PARKING MARKING MATERIALS

- A. Traffic lane marking paint with chlorinated rubber base.
- B. Factory mixed, quick drying and non bleeding, FS TT-P-

115C, Type III.

- C. Color: Driving Lane Dividers - White
No Parking Zone - Yellow
Parking Dividers - White

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Subbase Preparation:

1. The Contractor shall remove from the area all organic substance encountered to a depth of six or eight inches (6" or 8"), or to such depth and width as directed by the Engineer. The entire area shall be plowed and dragged prior to placing a stabilizing additive, if required to meet minimum bearing value.
2. Subbase shall be compacted to a minimum density of 98 percent of the maximum as determined by the Modified Proctor Density AASHTO T180, and shall have a minimum bearing value of 40 pounds per square inch as determined by the Florida Bearing Test.

B. Base Course:

1. Check subgrade for conformity with elevations and section immediately before placing base material.
2. Place base material in compacted layers not more than 6 inches thick, unless continuing tests indicate the required results are being obtained with thicker layers.
3. In no case will more than 8-inches of compacted base be placed in one lift.
4. Spread, shape, and compact all base material deposited on the subgrade during the same day.
5. Compact base course material to be not less than 95% of maximum density: ASTM D 1557, Method D (98 percent maximum density: AASHTO T-180).
6. Test density of compacted base course: ASTM D 2167.
7. Conduct one test for each 250 sq. yds. of in-place material, but in no case not less than one daily for each layer.

C. Loose and Foreign Material:

1. Remove loose and foreign material from compacted subbase surface immediately before application of paving.
2. Use power brooms or blowers, and brooming as

- required.
3. Do not displace subbase material.

D. Prime Coat:

1. Uniformly apply at rate of 0.20 to 0.5 gal. per sq. yd. over compacted and cleaned subbase surface.
2. Apply enough material to penetrate and seal, but not flood the surface.
3. Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 24 hours unless otherwise acceptable to the Engineer.
4. Blot excess asphalt with just enough sand to prevent pick-up under traffic.
5. Remove loose sand before paving.

E. Tack Coat:

1. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or portland cement concrete and similar surfaces.
2. Apply at rate of 0.05 to 0.15 gal. per sq. yd. of surface.
3. Apply tack coat by brush to contact surfaces of structures projecting into or abutting asphalt concrete pavement.
4. Allow surfaces to dry until material is at condition of tackiness to receive pavement.

3.02 MANHOLE FRAME ADJUSTMENTS (IF APPLICABLE)

A. Placing Manhole frames:

1. Surround manhole frames set to elevation with a ring of compacted asphalt concrete base prior to paving.
2. Place asphalt concrete mixture up to 1 in. below top of frame, slope to grade, and compact by hand tamping.

B. Adjust manhole frames to proper position to meet paving.

C. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations.

D. Set cover manhole frames to grade, flush with surface of adjacent pavement.

3.03 PREPARING THE MIXTURE

- A. Comply with ASTM D 995 for material storage, control, and mixing, and for plant equipment and operation.

B. Stockpiles:

1. Keep each component of the various-sized combined aggregates in separate stockpiles.
2. Maintain stockpiles so that separate aggregate sizes shall not be intermixed.

C. Heating:

1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture
2. Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt.
3. Do not exceed 350 degrees F. (176.6 degrees C.).

D. Aggregate:

1. Heat-dry aggregates to reduce moisture content to not more than 2.0%.
2. Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.
3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements.

E. Mix aggregate and asphalt cement to achieve 90-95% of coated particles for base mixtures and 85-90% of coated particles for surface mixture, when tested in accordance with ASTM D 2489.

F. Transporting:

1. Transport asphalt concrete mixtures from mixing site in trucks having tight, clean compartments.
2. Coat hauling compartments with a lime-water mixture to prevent asphalt concrete mixture from sticking.
3. Elevate and drain compartment of excess solution before loading mix.
4. Provide covers over asphalt concrete mixture when transporting to protect from weather and to prevent loss of heat.
5. During periods of cold weather or for long-distance deliveries, provide insulation around entire truck bed surfaces.

3.04 EQUIPMENT

- A. Provide size and quantity of equipment to complete the work specified within project time schedule.
- B. Bituminous Pavers: Self-propelled that spread hot asphalt concrete mixtures without tearing, shoving or

gouging surfaces, and control pavement edges to true lines without use of stationary forms.

C. Rolling Equipment:

1. Self-propelled, steel-wheeled and pneumatic-tired rollers that can reverse direction without backlash.
2. Other type rollers may be used if acceptable to the Engineer.

D. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

3.05 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine.

B. Spread mixture at a minimum temperature of 225 degrees F. (107.2 degrees C.).

C. Inaccessible and small areas may be placed by hand.

D. Place each course at thickness so that when compacted, it will conform to the indicated grade, cross-section, finish thickness, and density indicated.

E. Paver Placing:

1. Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.
2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
3. Complete base courses for a section before placing surface courses.
4. Place mixture in continuous operation as practicable.

F. Hand Placing:

1. Spread, tamp, and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to Engineer.
2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.

G. Joints:

1. Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work.
2. Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.
3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.
4. Offset transverse joints in succeeding courses not less than 24 inches.
5. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.
6. Offset longitudinal joints in succeeding courses not less than 6 inches.
7. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

3.06 COMPACTING THE MIX

- A. Provide sufficient rollers to obtain the required pavement density.
- B. Begin rolling operations as soon after placing when the mixture will bear weight of roller without excessive displacement.
- C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.
- D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.
- F. Do not roll centers of sections first under any circumstances.
- G. Breakdown Rolling:
 1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
 2. Operate rollers as close as possible to paver without causing pavement displacement.
 3. Check crown, grade, and smoothness after breakdown rolling.

4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

H. Second Rolling:

1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.
2. Continue second rolling until mixture has been thoroughly compacted.

I. Finish Rolling:

1. Perform finish rolling while mixture is still warm enough for removal of roller marks.
2. Continue rolling until roller marks are eliminated and course has attained specified density.

J. Patching:

1. Remove and replace defective areas.
2. Cut-out and fill with fresh, hot asphalt concrete.
2. Compact by rolling to specified surface density and smoothness.
4. Remove deficient areas for full depth of course.
5. Cut sides perpendicular and parallel to direction of traffic with edges vertical.
6. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.07 MARKING ASPHALT CONCRETE PAVEMENT

A. Cleaning:

1. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.
2. Do not begin marking asphalt concrete pavement until acceptable to the Engineer.

B. Apply paint with mechanical equipment.

1. Provide uniform straight edges.
2. Not less than two separate coats in accordance with manufacturer's recommended rates.

3.08 CLEANING AND PROTECTION

A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the Engineer.

B. Protection:

1. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than 6

- hours.
2. Provide barricades and warning devices as required to protect pavement.
 3. Cover openings of structures in the area of paving until permanent coverings are placed (if applicable).

END OF SECTION

SECTION 02514

SOIL CEMENT BASE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to complete all soil cement base work as called for in the Contract Documents or as shown on the Drawings.
- B. The work shall include, but not be limited to:
 - 1. The construction of a soil cement base course (Permabase) to the limits called out in the Contract Documents or shown on the Drawings.
 - 2. The application of a bituminous prime coat.
 - 3. Employment of a professional engineering soil testing laboratory to assure quality control.

1.02 SUBMITTAL

The Contractor shall submit the certification of testing laboratory to show compliance.

1.03 QUALITY ASSURANCE

- A. The Owner shall employ a qualified testing laboratory to exercise quality control over compaction.
- B. All soil cement materials shall meet all the requirements of the standard specifications of the local government and Florida DOT Standard Specifications (Latest Edition).

PART 2 PRODUCTS

2.01 MATERIALS

- A. Where called for on the Drawings, paving shall have a six inch (6") thick soil cement base course, consisting of soil and portland cement uniformly machine mixed, moistened, compacted, finished and cured in accordance with the best practices of the trade, and in accordance with Section 270 of the State of Florida DOT Standard Specifications.
- B. Portland cement shall be applied at the rate required to produce a mix of not less than 300 psi (Lab Design)

compressive strength at seven days. Cement content by weight shall be a minimum of 5% and a maximum of 8%.

1. All portland cement shall be Type I and shall conform to the requirements of FDOT Specifications (Latest Edition), Section 921.
 2. All water used shall meet the requirements of FDOT Specifications (Latest Edition), Section 923.
 3. Cutback asphalt, Grade RC-70 or RC-250 (bituminous prime coat) shall meet requirements of the FDOT Specifications (Latest Edition), Section 916-2.
 4. Soil shall consist of the natural material in area to be paved or of approved select soil. Soil shall not contain any material retained on a 2-inch sieve, nor more than 45 percent retained on a No. 4 sieve, nor more than 35 percent or less than 5 percent passing the No. 200 sieve. The distribution and gradation of materials in the soil-cement lining shall not result in lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from surround material.
 5. The cover materials for the prime coat shall be either sand or screenings, non-plastic and free from appreciable amounts of silt, clay ball, and roots.
- C. A Type S-1 asphaltic concrete wearing surface, where specified, shall be applied in conformance the Contract Documents and the FDOT Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

- A. Before soil-cement processing begins, the area to be paved shall be graded and shaped to lines and grades as shown in the Plans or as directed by the Engineer. During this process, any unsuitable soil or material shall be removed and replaced with acceptable material. The subgrade shall be firm and able to support without yielding or subsequent settlement the construction equipment and compaction of the soil-cement hereinafter specified. Soft or yielding subgrade shall be corrected and made stable before construction proceeds.
1. The soil aggregate shall be so pulverized that, at the completion of moist mixing, 100 percent by dry weight passes a 1-inch sieve, and a minimum of 80 percent passes a No. 4 sieve, exclusive of gravel

or stone retained on those sieves.

2. Soil-cement shall not be mixed or placed when the soil aggregate or subgrade is frozen, or when the air temperature is below 45 degrees F (8 degrees C). However, when the air temperature is at least 40 degrees F (5 degrees C) and rising, soil-cement construction may proceed.
 3. Moisture in the soil at the time of cement application shall not exceed the quantity that will permit a uniform and intimate mixture of the soil and cement during mixing operation, and shall be no more than the optimum moisture content for the soil-cement moisture.
 4. The operations of cement application, mixing, spreading, compacting, and finishing shall be continuous and completed within four hours in daylight or under satisfactory lighting. Any soil-cement mixture that has not been compacted and finished shall not be left undisturbed for longer than 30 minutes.
- B. When the base is to be constructed of central plant-mix soil cement, the subgrade shall be moist for a depth of at least one inch at the time the mixed base course material is placed thereon.

3.02 CONSTRUCTION METHODS

- A. General
1. Mixing of the soil, cement, and water shall be accomplished either by the mixed-in-place or the central plant-mix method.
 2. The percentage of moisture in the soil at the time of cement application shall not exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations. For clay soils, it shall not exceed the optimum moisture content for the soil cement mixture. For any soils, the moisture content shall be within two percentage points above or below the optimum moisture content.
 3. During seasons of probability of freezing temperature, no cement or soil cement moisture shall be spread unless the temperature is at least 40 degrees F. in the shade and is rising.
 4. At completion of moist-mixing, the soil shall be so pulverized that 100 percent passes a one-inch sieve

and a minimum of 80 percent passes a No. 4 sieve, exclusive of gravel or stone retained on the No. 4 sieve.

B. Mixed-in-Place Process:

1. Where feasible, the entire width of the base shall be processed as a single operation. The specified quantity of cement shall be spread uniformly on the soil at the required rate of application, by means of an approved method. Spread cement that becomes displaced shall be replaced before mixing is started.
2. After the cement has been applied, mixing shall begin within 60 minutes unless otherwise directed by the Engineer. The soil and cement shall be initially mixed until the cement has sufficiently blended with the soil to prevent formation of cement balls when additional water is applied; then water added if necessary and the soil cement mixture remixed.
3. Processing may be to full depth in one course provided the satisfactory distribution of cement and water and the specified density can be obtained. If not, construction shall be in courses of such thickness that satisfactory results are obtained. Provisions shall be made to achieve adequate bonding between courses.
4. At the option of the Contractor, as an alternative to the above-described procedure, he may use an approved machine that will blend the cement and the soil and then add and mix-in any additional water that is necessary.

C. Central Plant-Mix Process

1. The soil cement and water shall be mixed in a pugmill, of either the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices which will accurately proportion the soil, cement, and water in the quantities specified. Soil and cement shall be mixed sufficiently to prevent cement balls from forming when additional water is added. Mixing shall continue until a uniform and intimate mixture of soil, cement, and water is obtained. The materials shall be mixed a minimum of 30 seconds.
2. The mixture shall be hauled to the roadway in trucks equipped with protective covers. The mixture shall be placed on the moistened subgrade

in a uniform layer by an approved spreader. Not more than 30 minutes shall elapse between the placement of soil cement in adjacent passes of the spreader at any location, except at longitudinal construction joints. The layer of soil cement shall be uniform in thickness and surface contour, and in such quantity that the completed base will conform to the required grade and cross section. Dumping the mixture in piles or windows upon the subgrade will not be permitted.

3.03 **COMPACTION**

- A. Compaction of the soil cement mixture shall begin immediately after mixing is completed. In no case shall more than 60 minutes elapse between the last pass of moist-mixing and the start of compaction of the soil cement mixture at a particular location.
- B. At the start of the final compaction operation, the percentage of moisture in the mixture and in unpulverized soil lumps, based on dry weights, shall not be more than two percentage points above or below the optimum moisture content.
- C. The optimum moisture content and maximum density shall be determined in the field by the methods prescribed in AASHTO T 134, on representative samples of the soil cement mixture obtained from the area being processed.
- D. The loose mixture shall be uniformly compacted to not less than 95 percent of the maximum density. During compaction operations, shaping may be required to obtain uniform compaction and required grade and cross section.

3.04 **FINISHING**

- A. After compaction, the surface of the soil cement shall be shaped to the required lines, grades and cross section. In all cases where soil cement mixture is added to any portion of the surface, the surface shall be lightly scarified with a spring tooth harrow, spike drag, or other approved device, such that the surface is uniformly loosened prior to addition of material and prior to addition of material and prior to initial set of the soil cement mixture. The resulting surface shall then be compacted to the specified density. Rolling shall continue until all rutting ceases and until the entire base conforms to the density requirements.
- B. The moisture content of the surface material shall be maintained at not less than two percentage points below its specified optimum moisture content, during finishing operations. Surface compaction and finishing shall be

done in such manner as to produce a smooth, dense surface, free of compaction planes, cracks, ridges and loose materials.

3.05 CONSTRUCTION JOINTS

At the end of each day's construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face. The construction joint shall be located such as to exclude all of that part of the base at the end of the run which does not meet the requirements of the Specifications and the typical section.

3.06 CURING

A. Surface Requirements

After compacting and finishing have been completed, and not later than the beginning of the next calendar day after the construction of any section of base, the surface shall be tested with a template cut to the required crown and with a 15-foot straightedge laid parallel to the centerline, and all irregularities greater than 1/4 inch shall be immediately corrected with a blade adjusted to the lightest cut which will insure a surface that does not contain depressions greater than 1/4 inch under the template or the straightedge. In the testing of the surface, the measurements will not be taken in small holes caused by individual rocks having been pulled out by the blade. The material removed shall be wasted.

B. Protection Against Drying

1. During the period when finishing and surface correction operations are being accomplished, the surface of the base shall be kept continuously moist by sprinkling as necessary. Subsequent to this period, it shall be protected from drying for seven days, by application of cut-back asphalt, Grade RC-70, applied at the rate of 0.15 to 0.20 gallons per square yard. The actual rate of application shall be as directed and shall provide complete coverage without excessive runoff. At the time the bituminous material is applied, the soil cement surface shall be dense, and free of all loose and extraneous material, and shall contain sufficient moisture to prevent excessive penetration of the bituminous materials.
2. Should it be necessary to allow construction equipment or other traffic to use the completed base before the bituminous material has cured

sufficiently to prevent pickup or displacement, the bituminous material shall be sanded, using approximately ten pounds of clean sand per yard.

3.07 OPENING TO TRAFFIC

No traffic shall be permitted on the base subsequent to completion of the finishing operations for a period of seven days. As an exception to this requirement, the equipment necessary for correction of surface irregularities, application of water and application of curing materials will be allowed provided that the tire contact pressures of such equipment do not exceed 45 pounds per square inch. After the seven-day curing period, the base may be opened to traffic provided that it either is protected or has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic.

3.08 MAINTENANCE

The Contractor shall maintain the base to a true and satisfactory surface until the wearing surface is constructed. Should any repairs or patching be necessary, they shall extend to the full depth of the base and shall be made in a manner that will assure restoration of a uniform base course conforming to the requirements of these Specifications. In no case shall repairs be made by adding a thin layer of soil cement to the completed work. The Contractor may, at his option, make full depth repairs to small or minor areas, such as at manholes, inlets, or the like, with Class I concrete.

3.09 THICKNESS MEASUREMENT

- A. During various stages of construction, test holes shall be dug in the mixture to determine the thickness. After the base is completed, test holes shall be dug or drilled and the thickness of the base shall be determined from measurements made in these test holes.
- B. Where the base is deficient in thickness by more than 1/2 inch, the area of deficient base shall be removed and replaced by base of the required thickness, at the Contractor's expense.
- C. As an exception to the above, if the deficiency is considered to not be sufficient to seriously impair the required strength of the base, the deficient area may be left in place. No payment will be made for the base or the theoretical amount of cement used in areas left in place without correction.

3.10 MINIMUM STANDARDS

All work shall be done in accordance with these Specifications and with the Florida DOT Standard Specifications (Latest Edition), Sections 270, 300-3, 300-6, 916-2 and 921.

3.11 TESTING

- A. The pills cast from project operations must break at 200 psi or higher at 7 days.
- B. Cores may be taken at 14 days to provide additional information regarding a soil cement section. The soil cement shall be tested by coreboring and laboratory testing of samples, such tests to be conducted by an independent approved laboratory. A minimum of five cores shall be tested and shall be 6" in diameter. The location and number of cores taken will be at the discretion of the Owner/Engineer or his authorized representative. Core breaks below 150 psi will not be acceptable. Sections not meeting these Specifications shall be reconstructed at no additional cost to the Owner. Results of all tests shall be submitted for approval.

END OF SECTION

SECTION 02515

SHELL BASE MATERIALS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials and equipment, and incidentals required to complete all shell base work as called for in the Contract Documents or as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. Shell materials for shell base or shell stabilized base, shall consist of naturally occurring deposits formed essentially of broken mollusk shell, corals and the skeletal remains of other marine invertebrates. Live or steamed shell, or man-made deposits as a by-product of the shellfish industry shall not be permitted.
- B. Sources of supply shall be approved by the County, with materials produced under the requirements of the FDOT Standard Operating Procedure for Evaluation, Approval and Control of Mineral Aggregate Sources, Limerock, Cemented Coquina and Shell Base Materials, except as noted herein.
- C. Shell materials shall be reasonably free of lumps of clay, organic matter, and other substances not defined which may possess undesirable characteristics. The material shall not contain silica sand in sufficient quantity to prevent bonding.

1.03 PHYSICAL AND CHEMICAL PROPERTIES

Shell materials shall meet the following physical and chemical requirements:

Limerock Bearing Ratio (FM 5-515) - The material shall have an LBR value of not less than 100. Material represented by any individual LBR value of less than 100 is unacceptable.

Plasticity (FM 1-T 089 and 090) - That portion of the material passing the No. 40 sieve shall be non-plastic.

Carbonates (FM 5-514) - The minimum percentage of carbonates of calcium and magnesium shall be 50.

PART 2 PRODUCTS

2.01 MATERIALS

A. DREDGED SHELL (FDOT: 913-2)

1. Definition (FDOT: 913-2.1)

Dredged shell shall be defined as those shell materials meeting the requirements of FDOT Specification 913-1, which are dredged from ocean, bay or lake deposits.

2. Gradation Requirements (FDOT: 913.2.2)

Materials classified as Dredged Shell shall meet the following gradation requirements:

Passing 3-1/2" sieve 97% (Maximum dimension not to exceed six-inch)

Passing No. 4 sieve Maximum 50%

Passing No. 200 sieve Maximum 7.5% (by weight)

B. Bank-Run Shell (FDOT: 913-3)

1. Definition (FDOT: 913-3.1)

Bank-run shell shall be defined as those shell materials meeting the requirements of FDOT Specification 913-1 which are presently found as "dry land" deposits.

2. Gradation Requirements (FDOT: 913-3.2)

Materials classified as bank-run shell shall meet the following gradation requirements:

Passing 3-1/2" sieve 97% (Maximum dimension not to exceed six-inch)

Passing No. 4 sieve Maximum 80%

Passing No. 200 sieve Maximum 20% (washed)

C. Materials for Subbase Stabilization

1. Materials designated for this use shall meet the FDOT Specifications Section 914 as modified by FDOT or materials meeting Manatee County Specification for Shell Base or Sun City Shell.

D. Crushed Concrete Aggregate Base Material

1. Crushed concrete shall meet Manatee County Transportation Department requirements.
2. Concrete with reactive aggregates shall not be used.
3. Concrete which has been contaminated by hazardous materials shall not be used.
4. Minimum LBR is 100.

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:

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.

- 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

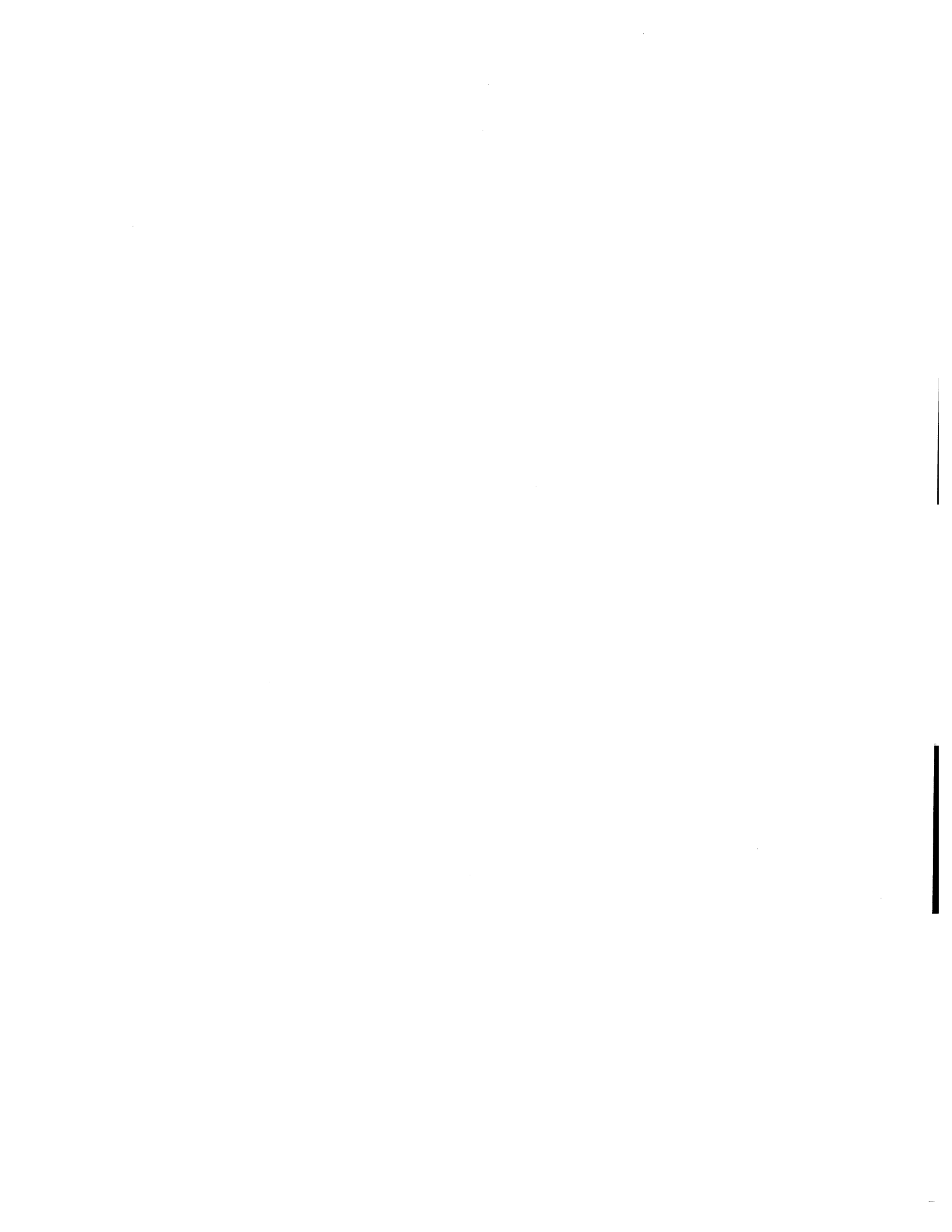
2.02 DETECTION

- 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 re-tested at the County's request.
- G. Disconnect water supply during test.
- H. All force mains will be tested from the valves in the valve vault at the lift station to the point of connection whether it be against a valve on another force main or into a manhole.
- I. All services to be aboveground during test. The services should be the correct length so they will be one (1) foot inside right-of-way line.
- J. All fire hydrant gate valves to be open during test.
- K. All visible leaks are to be repaired, regardless of the amount of leakage.
- L. Check gauge pressure periodically during test. If test pressure drops to 175 psi for water/reclaimed lines or to 145 psi for force mains during test, the line must be repumped back to 180 psi for water/reclaimed (150 psi

force mains) and the amount of leakage measured. The test will continue on with the remaining time left. At the end of the test, the line must be repumped again back to 180 psi (150 psi for force main) and the amount of leakage measured and added to any previous leakage determined earlier in the test.

- M. After the line passes the test, the pressure will be blown off from the opposite end of line from the gauge location. Fire hydrants, services and end-of-line blow offs will be opened to demonstrate they were on line during the test.
- N. At end of test, the test gauge must return to zero. The pressure gauge must read 0 psi to a maximum of 300 psi in 5 psi increments.
- O. The section of line being tested must be identified on the charge sheet. The length and size of pipe, the exact area being tested and the valves being tested against, must be identified. Use Station numbers if available.
- P. A punch list must be made at the end of all tests.
- Q. A copy of the charge sheet will be given to the 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 dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of the 1/8-inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where the EPDM seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where the EPDM seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.
- D. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Butterfly valves of the "wafer" or "spool" type will not be accepted.
- E. The valve shaft shall be turned, ground, and polished constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.
- F. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The hydrostatic test for Class 250 valves shall be performed with an internal hydrostatic pressure equal to 500 psi applied to the inside of the valve body of each valve for a period of five minutes. During the hydrostatic test, there shall be no leakage through the metal, the end joints or the valve shaft seal. The leakage test for the Class 250 valves shall be performed at a differential pressure of 230 psi and against both sides of the valve. No adjustment of the valve disc shall be necessary after pressure test for normal operation of valve. The Class 150 valves shall be tested in conformance with AWWA C-504.
- G. In general, the butterfly valve operators shall conform to the requirements of Section 3.8 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable, and as herein specified.
- H. Gearing for the operators shall be totally enclosed in a

gear case in accordance with paragraph 3.8.3 of the above mentioned AWWA Standard Specification.

- I. Operators shall be capable of seating and unseating the disc against the full design pressure of velocity, as specified for each class, into a dry system downstream and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.
- J. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform with all requirements of this Specification and the AWWA standard.
- K. Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

2.05 PLUG VALVES

- A. All plug valves shall be eccentric plug valves capable of sustaining 150 psi in either direction without leaking.

Exception: Single direction plug valves may be used if it is clearly demonstrated they will never be required to resist pressure in both directions either in service or during pipe line testing.

- B. Plug valves shall be tested in accordance with current AWWA Standard C-504-80 Section 5. Each valve shall be performance tested in accordance with paragraph 5.2 and shall be given a leakage test and hydrostatic test as described in paragraphs 5.3 and 5.4. 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 Limitorque Corporation, Type L120 or approved equal.

2.07 AIR RELEASE VALVES

The air release valves for use in water or force mains shall be installed as shown on the Drawings. The valves shall have a cast iron body cover and baffle, stainless steel float, bronze water diffuser, Buna-N or Viton seat, and stainless steel trim. The fittings shall be threaded. The air release valves shall be Model 200A or 400A as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois; or approved equal.

2.08 VALVE BOXES

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 nonschock. 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 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



SECTION 03010
CONCRETE WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

The extent of concrete work is shown on the Drawings.

1.02 RELATED WORK

- A. Section 01340 - Project Data, Samples and Shop Drawings

1.03 SUBMITTALS

- A. **Manufacturer's Data:** For information only, submit manufacturer's specifications with application and installation instructions 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:** Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures.
- C. **Laboratory Test Reports:** Submit laboratory test reports for concrete materials and mix design test as specified.

1.04 REFERENCE STANDARDS

Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified:

- A. ACI 301 "Specifications for Structural Concrete for Buildings"
- B. ACI 305 "Hot Weather Concreting"
- C. ACI 306 "Standard Specification for Cold Weather Concreting"
- D. ACI 311.4R "Guide for Concrete Inspection"
- E. ACI 315 "Manual Of Standard Practice For Detailing Reinforced

Concrete Structures"

- F. ACI 318 "Building Code Requirements for Reinforced Concrete"
- G. ACI 347 "Recommended Practice for Concrete Formwork"
- H. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"
- I. ACI 540R "Guide to Sealing Joints in Concrete Structures"
- J. Concrete Reinforcing Steel Institute, "Manual of Standard Practice"
- K. Where local building code requirements exist, comply with provisions of such codes, which are more stringent than the preceding codes and standards.

1.05 QUALITY ASSURANCE

- A. Workmanship: The Contractor is responsible for correction of concrete work, which does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as approved by the Engineer. All defects shall be repaired to Owner's satisfaction.
- B. Construction Tolerances
 - 1. Variation from Grade: For grades shown for slabs, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 foot maximum, nor 3/4 inch in 40 feet or more.
 - 2. Variation from Linear Building Line: For position shown in plan do not exceed 1/2 inch in 20 foot maximum, nor one inch in 40 feet or more.
 - 3. Variation in Cross-Sectional Dimensions: For thickness of slabs, do not exceed minus 1/4 inch nor plus 1/2 inch.

1.06 TESTING AND MIX DESIGN

- A. Testing Before Construction: Employ concrete testing laboratory, acceptable to the Owner, at Contractor's expense to perform material evaluation tests and to design concrete mixes.
- B. Tests for Concrete Materials
 - 1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C-150.
3. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing, when acceptable to the Engineer.
4. Proportioning and Design of Mixes
 - a. Prepare design mixes for each type of concrete. Use an independent testing facility acceptable to the Owner for preparing and reporting proposed mix designs.
 - b. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1.
 - c. 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 approved by the Engineer.
5. Laboratory Trial Batches
 - a. When laboratory trial batches are used to select concrete proportions, prepare test specimens in accordance with ASTM C192 and conduct strength tests in accordance with ASTM C39, as specified in ACI 301.
 - b. Establish a curve showing relationship between water-cement ratio (or cement content) and compressive strength with at least three points representing batches which produce strengths above and below that required. Use not less than three specimens tested at 28 days, or an earlier age when acceptable to the Engineer, to establish each point on the curve.
6. Field Experience Method
 - a. When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301.
 - b. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least thirty consecutive tests in one group or the statistical average for two groups totaling thirty or more tests,

representing similar materials and projects conditions.

- c. Standard Deviation: If standard deviation exceeds 600 psi or if no suitable records are available, select proportions to produce an average strength of at least 1200 psi greater than the required compressive strength of concrete.
 - d. After sufficient experience and test data become available from the job, using ACI214 methods of evaluation, the standard deviation may be reduced when the probable frequency of an average of three consecutive tests below required compressive strength will not exceed one in one hundred.
7. Adjustment to Concrete Mixes
- a. Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Engineer.
 - b. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Engineer before using in the work.
8. Compressive Strength: 4,000 PSI (minimum)
9. Admixtures: Use air-entraining admixture in all concrete, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content by volume within the following limits:
- a. 6% to 9% for maximum aggregate 1/2 inch and under.
 - b. 4% to 6% for maximum aggregate over 1/2 inch through 1-1/2 inch.
 - c. 2.5% to 4.5% for maximum aggregate over 1-1/2 inch.
10. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:
- a. Ramps and Sloping Surfaces: Not more than 4 inches.
 - b. Reinforced Foundation Systems: Not less than 3 inches and not more than 5 inches.

- c. All Other Concrete: Not less than 3 inches and not more than 6 inches.
11. Testing During Construction
- a. Employ at Owner's expense a testing laboratory.
 - b. The following quality control testing is required during construction:
 - c. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
 - d. Slump: ASTM C143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens; additional tests when concrete consistency seems to have changed.
 - e. Compressive Strength: ASTM C39; one set of 4 standard cylinders (ASTM C31) for each 50 cubic yards or fraction thereof, of each concrete class placed in any one day or for each 5,000 square feet of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 - f. When the total quantity of a given class of concrete is less than 50 cubic yards, or the quantity of concrete for any single structure is less than 10 cubic yards, the Engineer may waive compressive strength testing, but such action shall not relieve the Contractor from responsibility for furnishing concrete of the required strength.
 - g. The strength level of concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the specified strength by more than 500 psi.
 - h. Air Content: ASTM C231, pressure method or ASTM C173; one for each set of compressive strength test specimens.
 - i. Additional Tests: When test results indicate specified concrete strengths and other characteristics have not been attained, perform additional testing to determine the extent to which deficiencies exist. Additional testing program is to be performed by a testing laboratory and acceptable to the Engineer. Where cored cylinders are utilized to

determine adequacy of concrete, comply with ASTM C42. It is the Contractor's responsibility to pay for additional testing.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct all 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. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

Where plywood is used in form-work, provide material complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete For", Class I, unless otherwise acceptable to Engineer.

- B. 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 two edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60 unless otherwise shown.
- B. Steel Wire: ASTM A82, plain, cold-drawn, steel.
- C. Welded Wire Fabric: ASTM A185, 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 complying with CRSI recommendations, unless otherwise specified. Solid precast concrete block may be used for supporting footing and foundation mats against earth material. Wood, clay, brick and other non-standard devices will not be acceptable.
1. For slabs-on-grade, use supports with sand plates or horizontal runners where

base materials 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.

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type II, unless otherwise acceptable to Engineer.

Use only one brand of cement throughout the project, unless otherwise acceptable to Engineer.

- B. Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for all exposed concrete.

1. Fine Aggregate: Clean, sharp, natural sand from loam, clay, lumps or other deleterious substances.

2. Coarse Aggregate: Clean, uncoated, crushed granite or similar hard stone processed from natural rock or stone, and containing no clay, mud, loam or foreign matter.

3. Maximum Aggregate Size: 1-1/4 inches.

- C. Water: Clean, fresh, and safely drinkable by humans.

- D. Air-Entraining Admixture: ASTM C260.

- E. Fly Ash and Other Pozzodanic Materials: ASTM C618, Type C or Type F

2.04 RELATED MATERIALS

- A. Grout: Ready mixed Portland cement, sand and water mixture conforming with materials and mix design of highest strength project-required concrete except for deletion of coarse aggregate.

- B. Non-shrink Grout: Factory-premixed cementitious material containing no corrosive material, which is non-shrink from time of placement and shows no expansion after final set when tested under ASTM C827, has an initial setting time of not less than 45 minutes, has a 24 hour compressive strength of not less than 4,000 psi under ASTM C109 for a trowelable mix, and is selected and applied in conformance with manufacturer's recommendations.

- C. Waterstops: Provide flat, dumbbell type or center-bulb type waterstops at

construction joints and other joints as indicated. Size to suit joints. Polyvinyl chloride as per CE CRD-C572.

- D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately nine ounces per square yard, complying with AASHTO M182, Class 2.
- E. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
 - 1. Waterproof paper
 - 2. Polyethylene film
 - 3. Polyethylene-coated burlap
- F. Membrane-Forming Curing Compound: ASTM C309, Type 1 unless other acceptable to Engineer.
- G. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

2.05 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 85oF and 90oF, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90oF, reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMS

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members structures are of correct size, shape, alignment, elevation and position.

- B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms complying with ACI 347, 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 back-up at joints to prevent leakage of cement paste.
- D. Fabricate forms for easy removal without hammering or prying against the 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, and the like, to prevent swelling and for easy removal.
- E. Provide temporary openings where interior area of formwork is inaccessible for clean-out, 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. Locate temporary openings on forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as shown, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Form Ties: Factory-fabricated, adjustable-length, metal form ties, designed to prevent form deflection, to prevent spalling concrete surfaces upon removal, and to prevent passage of water along tie surface through concrete.
- H. Provide ties so portion remaining within concrete is at least 1 inch inside concrete, and do not leave holes larger than one inch diameter in concrete surface.
- I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- J. 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 if required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

- A. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute'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, ice, 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 chairs, runners, bolsters, spacers and hangers, as required.
- D. Place reinforcement to obtain at least the minimum coverages for concrete protection. 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. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- F. Install welded wire fabric in lengths as long 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.

3.03 JOINTS

- A. Construction Joints: Locate and install necessary construction joints, which are not shown on the Drawings, so as not to impair the 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, unless noted.
- D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any point.

- E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs on ground as shown on the Drawings.
- F. 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.
- G. 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.

3.04 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into the 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 the 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 the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screeds required. Align the concrete surface to the elevation of the screed strips by the use of strike-off templates or accepted compacting type screeds.

3.05 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. Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.06 CONCRETE PLACEMENT

- A. Pre-Placement Inspection: Before placing concrete, inspect and complete the

- formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work, as required. Moisten wood forms immediately before placing concrete, where form coatings are not used.
- B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
 - C. Construction Sequence: Before placing any concrete, complete blasting, heavy earthwork and other construction operations, which might cause damage to concrete structures.
 - D. General: Comply with ACI 304, and as herein specified. 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 within the section. 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 due to rehandling or flowing.
 - E. 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.
 - F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309 recommended practices.
 - G. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
 - H. Placing Concrete Slabs: Deposit and consolidate concrete in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
 - I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

- J. Bring slab surfaces to the correct level with a straightedge and strike-off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not disturb the slab surfaces prior to beginning finishing operations.
- K. Maintain reinforcing in the proper position during concrete placement operations.
- L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306R and as herein specified.
- M. Hot Weather Placing: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305R and as herein specified.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90oF. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 - 3. Fog spray forms, reinforcing steel and sub-grade just before concrete is placed.
 - 4. Do not use retarding admixtures without the written acceptance of the Engineer.

3.07 FINISH OF FORMED SURFACES

- A. Concealed Surfaces: For formed concrete surfaces not exposed-to-view in the finished work, leave surface finish imparted by the form facing material used, with defective areas and form tie voids repaired and patched as specified, and fins and other projections exceeding 1/4 inch in height rubbed flush.
- B. Visible Surfaces: For formed concrete surfaces expose-to-view, including those surfaces of water or other material holding structures visible when the structure is empty, or surfaces that are to be covered with a thin or flexible finish material bonded to the concrete, perform finish operations as specified above under "Concealed Surfaces", and in addition wet and rub entire surfaces with a carborundum stone of medium fineness until all form marks and other surface irregularities have been removed and a uniform surface appearance achieved. Do not create a plaster coating on concrete.

- C. Unformed Visible 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.

3.08 MONOLITHIC SLAB FINISHES

- A. Float Finish: Apply float finish to monolithic slab surfaces that are 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 floats.
 2. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.
 3. Check and level surface plane so that depressions between high spots do not exceed 6/16 inch under a 10 foot straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains.
 4. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- B. Trowel Finish: Apply trowel finish to monolithic slab surfaces that are to be exposed-to-view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.
1. After floating, begin the 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.
 3. Grind smooth surface defects which would telegraph through applied floor covering system.
- C. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms,

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.
2. Coordinate required final finish with the Engineer before application.

3.09 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying, and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening.

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 seven days and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by one or more of the following methods as selected by the Contractor:

1. Moisture Curing
 - a. Provide moisture curing by 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 cover.
 - b. Provide moisture-cover curing by covering concrete surfaces with moisture-retaining cover, 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 water-proof tape.
2. Membrane Curing
 - a. Provide membrane curing by applying compound to damp concrete surfaces as soon as film has disappeared. Apply uniformly in continuous operation by power-spray or roller equipment in

accordance with manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- b. Do not use membrane curing compounds on surfaces which are to be covered with a coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.
3. 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.
4. Curing Unformed Surfaces: Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing.
5. Final cure unformed surfaces, unless otherwise specified, by methods specified above, as applicable.

3.10 FORM REMOVAL

- A. In all cases, time and sequence of concrete form removal is at Contractor discretion.
- B. Formwork supporting weight of concrete, such as beams and slabs must remain in place at least 14 days and until concrete has attained minimum design 28 day compressive strength.
- C. Formwork not supporting weight of concrete such as sides of beams, walls and columns, may be removed no sooner than 48 hours after placement of concrete or when concrete is sufficiently hard as not to be damaged by form removal operations.

3.11 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. 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 lutein, and tighten forms to close joints. Align and secure

joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to 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. 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.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- D. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

3.13 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, but only when acceptable to Engineer. Cut out honeycomb, rock pockets, voids over 1/8 inch in any dimension and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than one inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to Engineer.
 - 1. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color of surrounding surface. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
 - 2. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets and holes left by tie rods and bolts; 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 core plugs secured in place with bonding agent.

3. Repair concealed formed surfaces, where possible, that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.
4. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to tolerances 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 a required slope.
5. Repair finished unformed surfaces that contain defects which adversely 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.
6. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
7. 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.
8. Repair defective areas, except random cracks and single holes not exceeding one 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 brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of same materials to provide concrete of the same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
9. Repair isolated random cracks and single holes not over one 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 brush with neat cement grout coating or concrete bonding agent. Place dry-pack before cement grout takes its initial set. Mix dry-pack,

consisting of one part Portland cement to 2½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

10. Repair methods not specified above may be used, subject to acceptance of Engineer.
- B. Agreement by the Engineer to permit repair or patching of concrete does not waive the Owner's authority to require complete removal and replacement of defective concrete pours should the patch not prove satisfactory to the Owner, due either to deficiency in strength, function or appearance.

END OF SECTION



SECTION 03180

CORROSION-RESISTANT POLYMER LINING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish and install all labor, materials, equipment, and incidentals required to supply and install corrosion resistant polymer lining on the influent channels, three screening channels, headcell grit unit walls, all open channels between the screens and effluent channels, effluent box to the future equalization basin.
- B. Corrosion-resistant polymer liner shall be designed and installed to protect concrete surfaces from corrosion.
- C. It is the intent of these Specifications to polymer-line the interior surfaces of the influent structure. These surfaces are exposed to H₂S, humidity, water, other components of raw sewage, and the corrosive by-products formed above the water level.
- D. The interior surfaces mentioned in Paragraph C above shall be further defined as follows:
 - 1. The influent channels/boxes, screening channels, (automatic and manual), channels between the screens and effluent channels/boxes shall have the walls lined from top to bottom.
 - 2. The two (2) headcell grit chamber walls shall be lined from elevation 60.50 to 47.92.
 - 3. The influent box to the future equalization basin shall have the walls and bottom lined.

1.02 RELATED WORK (REQUIREMENTS)

- A. The following is a partial list of, but no necessarily limited to, other sections of the specifications that are applicable to the specified equipment or structure described herein that are referred to for reference and are not included in this section. There are other sections of these specifications that are also applicable and the CONTRACTOR is advised to review these sections and adhere to the requirements specified herein.

1. Concrete work is included under Section 03010.

1.03 SUBMITTALS

- A. The CONTRACTOR shall submit for review, as provided in article entitled "Shop Drawings and Submittals" of the General Conditions, complete detailed shop drawings and a coating schedule for all materials furnished under this section.
- B. The MANUFACTURER of the lining shall furnish an affidavit attesting to the successful use of its material as a lining for concrete structures for a minimum period of five (5) years in wastewater conditions recognized as corrosive or otherwise detrimental to concrete.
- C. The lining system shall be applied by a qualified applicator trained in handling mixing and application of the material including the required surface cleaning and preparation. A list of references of projects in Florida using the specified lining system shall be provided to the ENGINEER for review.
- 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.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 1. ASTM 307 Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
 2. ASTM C308 Standard Test Methods for Working, Initial Settings, and Service Strength Setting Times of Chemical-Resistant Resin Mortars
 3. ASTM C413 Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
 4. ASTM C476 Standard Specification for Grout for Masonry
 5. ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections
 6. ASTM C579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, monolithic Surfacing and Polymer Concretes
 7. ASTM C580 Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 8. ASTM C905 Standard Test Methods for Apparent Density of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. Composition

1. The material used in the liner shall be a combination of powder, liquid and hardener which must be mixed together as used, specifically compounded to protect concrete surfaces from corrosion.

B. Physical Properties

1. All cured corrosion-resistant polymer lining shall be free of cracks, cleavages, or other defects adversely affecting the protective characteristics of the material. The ENGINEER may authorize the repair of such defects by approved methods.
2. The lining shall have good impact resistance, shall be flexible, and shall have sufficient elongation to bridge hairline cracks in the concrete.
3. The lining shall be repairable at any time during the life of the structure.
 - a. The corrosion-resistant polymer lining shall have the physical properties as given in either Table 1 or Table 2 below:

Table 1

Absorption (ASTM C-413)	0.1%
Working Time – 70° F (ASTM C-308 modified)	40 – 50 minutes
Initial Set Time – 70° F (ASTM C-308 modified)	13 hours
Bond Strength to Dry/Damp Concrete Manhole (ASTM C-478)	Concrete Failed
Compressive Strength (ASTM C-579)	7300 psi (6.26 x 10 ⁶ Kg/M ²)
Density (ASTM C-905) (1.7 x 10 ³ Kg/M ³)	113 pcf
Flexural Strength (ASTM C-580) (6.5 x 10 ⁶ Kg/ M ²)	4900 psi
Modulus of Elasticity (ASTM C-580) (1.8 x 10 ⁸ Kg/M ²)	2.75 x 10 ⁵ psi
Tensile Strength (ASTM C-307) (2.7 x 10 ⁶ Kg/M ²)	2,000 psi

Thermal Coefficient of Linear Expansion (ASTM D-696) 3.5×10^{-5} in/in/°F

Table 2

Absorption (ASTM C-413)	<0.03%
Working Time – 70° F (ASTM C-308 modified)	30 – 40 minutes
Initial Set Time – 70° F (ASTM C-308 modified)	14 hours
Bond Strength to Dry/Damp Concrete Manhole (ASTM C-476)	Concrete Failed
Compressive Strength (ASTM C-579)	4386 psi
Flexural Strength (ASTM C-580)	1200 psi
Modulus of Elasticity (ASTM C-580)	30,000psi
Tensile Strength (ASTM C-307)	1529 psi
Thermal Coefficient of Linear Expansion	3.78×10^{-5} in/in/°F

- C. The corrosion-resistant polymer lining shall be Corrosion-Clad Polymer Lining No. 210 as manufactured by Sauereisen Cements Company or Plasite 5371 as manufactured by the Wisconsin Protective Coating Corp., Green Bay, Wisconsin, or equal.
- D. Storage of Materials
1. Store material in an approved area within a temperature range of 65-80° F, for 48 hours prior to use.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Condition of Working Area
1. Corrosion-resistant polymer lining shall be applied to surfaces between 65 - 80° F. If the surface temperature is between 50-65° F or 80-90° F, the corrosion-resistant polymer lining may be applied, however, the CONTRACTOR must contact the MANUFACTURER for a written recommendation prior to application.
 2. Concrete surfaces requiring excessive repairs beyond the economic capability of the epoxy lining shall be repaired with cementitious materials. Available

in both horizontal and vertical grades, quick set concretes can be used to patch or overlay existing deteriorated concrete surfaces or may be used with forms to reconstruct tank pads or pump bases.

- a. For small areas in need of repair, repairs shall be accomplished using a specifically modified magnesium phosphate concrete patching mortar. This mortar shall be a single component product requiring only the addition of water. Magnesium phosphate concrete patching mortar shall be PLASITE® 120 as manufactured by Wisconsin Protective Coatings Corporation, Green Bay, Wisconsin or engineer-approved equal.
 - b. For larger areas in need of repair, a non-chloride, water reducing admixture may be used to accelerate the cure of standard concrete. The admixture shall comply with ASTM C-494, Type C and E admixtures, and shall be mixed and applied in strict accordance with MANUFACTURER'S instructions. The non-chloride, water reducing admixture shall be PLASITE® 130 as manufactured by Wisconsin Protective Coatings Corporation, Green Bay, Wisconsin or engineer-approved equal.
3. The CONTRACTOR shall consult the lining MANUFACTURER for recommendations to ensure compatibility between resurface and the lining.

B. Surface Preparation

1. New Concrete – The compressive strength of the concrete must be at least 4000 psi and have a minimum 28-day cure unless a quick-set, polymer type concrete is used prior to application of corrosion-resistant polymer lining. The accelerated polymer concrete mix design shall be in accordance with lining manufacturers written recommendations.
 - a. All surfaces of the concrete must be either abrasive-blasted using 16-30 mesh sand, or hydro-blasted. All surfaces must be dry prior to application. Coating MANUFACTURER shall provide standard testing procedures, such as ASTM-D4263-63, to determine if excess moisture is present in the concrete.
 - b. Concrete surfaces that have been cured with conventional curing compounds or are contaminated with form oils or grease must be chemically cleaned or scarified to remove these contaminants before abrasive blasting or hydroblasting is started.
 - c. Suitably finished concrete must have a uniform surface texture

exposing fine aggregate, and resembling coarse sandpaper. If surface texture is not uniform in appearance, repeat surface preparation procedure until the desired surface is obtained.

- d. If sandblasting is used as the method of surface preparation, remove all sand and debris by thoroughly vacuuming the area. If hydroblasting is used, all surfaces must be surface dry without any standing water prior to application of corrosion – resistant polymer lining.

C. Expedited Curing

1. Time to final cure is directly related to temperature. Should accelerated curing using external heat sources be desired, the CONTRACTOR will follow the proper force curing schedule as provided by the coating MANUFACTURER.
2. The temperature at which the coating MANUFACTURER expresses curing time should be noted. If local ambient temperatures are higher, shorter curing times should be expected. The CONTRACTOR should contact the coating MANUFACTURER for case histories in similar climates.

D. Application

1. Mixing – Corrosion-resistant polymer lining is packaged in a premeasured, unitized container consisting of liquid, hardener, and powder, which must be mixed together before use in accordance with MANUFACTURER'S recommendations.
2. Once the compound has begun to set, it cannot be recovered by adding more liquid – such material must be discarded.
3. Never add water, Portland Cement, or any other additive or adulterant to any component or the mixed compound.
4. Installation – Corrosion-resistant polymer lining is applied at 1/8-inch thickness by trowel. Corrosion-resistant polymer lining must be applied by an experienced applicator of the type of lining. Coverage may vary depending upon substrate conditions.
5. Curing – CONTRACTOR shall not allow water or chemicals on the corrosion-resistant polymer lining for a minimum of 24 hours at 70° F, cure a minimum of 48 hours prior to water or chemical exposure.

6. The lining is to be finished to a pinhole-free resin-rich surface by brush, or roller in specific accordance with the MANUFACTURER'S instructions to provide a sealed surface.
7. The finished lining shall be spark-tested by the applicator under the observation of the OWNER, to ensure a pinhole-free application. Any pinholes must be identified and repaired by the MANUFACTURER'S instructions.

E. Manufacturer's Assistance

1. Prior to job start up, a meeting shall be held including the OWNER, ENGINEER, CONTRACTOR, and coating MANUFACTURER or his representative.
2. A coating MANUFACTURER'S representative shall be available to the Applicator, at the job site, for assistance at the time of initial coating application. The coating MANUFACTURER'S representative shall provide guidance and hands-on application demonstration to the Applicator in order to achieve a comfortable and proficient working level.
3. MANUFACTURER shall certify in writing final coating within ten (10) days after application.

END OF SECTION



DIVISION 04
MASONRY

SECTION 04220

UNIT MASONRY

PART 1- GENERAL

1.01 SUMMARY

- A. Furnish and install concrete masonry units (CMU), precast concrete formed units, and miscellaneous masonry items as indicated on the Drawings and specified herein.

1.02 RELATED WORK

- A. CONCRETE WORK: Section 03010.

1.03 QUALITY ASSURANCE

- A. Erector's Qualifications: Installation shall be performed only by a qualified Mason and Brick Layer (for exposed work) with at least five (5) years documented experience in installations of a similar nature.
- B. Wherever a fire-resistance classification is shown, scheduled, or otherwise required for unit masonry construction, provide CMU and mortar as tested and listed for the particular construction.
- C. The CMU shall be obtained from one manufacturer, and cured by one process. All units shall be sound and free of cracks or other defects that could interfere with the proper laying of the unit or would impair the strength or permanence of construction. Minor cracks incidental to the usual method of manufacture, or minor chipping resulting from customary methods of handling in shipment and delivery are acceptable.
 - 1. CMU for exposed to view conditions shall be free of surface defects which are noticeable and objectionable from a distance of 10 feet.
 - 2. Color and Texture: The units shall be of uniform color and texture for each continuous area and visually related area.
- D. Neither the source nor the brands of mortar materials shall be changed during construction of this Project.
- E. The independent testing laboratory shall not be changed during the construction of the Project, unless otherwise approved by the Owner.

- F. Comply with recommendations of the National Lime Association and Portland Cement Association for mortar requirements.
- G. Protect masonry from freezing when the temperature of the surrounding air is 40 degrees F. and falling, with materials heated and temporary protection of completed portions of masonry work provided. Comply with all applicable governing codes and the "Construction and Protection Recommendations for Cold Weather Masonry Construction" of the Technical Notes on Brick and Tile Construction by the Brick Institute of America (BIA).
- H. Techniques of laying, finishing and grouting of masonry shall comply with requirements of American Concrete Institute (ACI) 530 "Building Code Requirements for Masonry Structures" and ACI 530.1 "Specifications for Masonry Structures."
- I. American Society for Testing and Materials (ASTM):
 - 1. Referenced Standards.
- J. Concrete Reinforcing Steel Institute (CRSI):
 - 1. "Manual of Standard Practice."

1.04 CONSTRUCTION TOLERANCES

- A. Variation from Plumb:
 - 1. Vertical Lines and Surfaces of Columns, Walls, and Arrises: Do Not Exceed:
 - a. 1/4" in 10'-0".
 - b. 3/8" in a story height, maximum 20'-0".
 - c. 1/2" in 40'-0" or more.
 - 2. External Corners, Expansion joints, Control Joints, and other Conspicuous Lines: Do Not Exceed:
 - a. 1/4" in any story, maximum 20'-0".
 - b. 1/2" in 40'-0" or more.
 - 3. Vertical Alignment of Head Joints: Do Not Exceed:
 - a. 3/8" in 10'-0".
- B. Variations From Level:
 - 1. Bed Joints and Lines of Exposed Lintels, Sills, Parapets, Horizontal Grooves and

other conspicuous lines: Do Not Exceed:

- a. 1/4" in any bay, maximum 20'-0".
- b. 1/2" in 40'-0" or more.

2. Top Surface of Bearing Walls: Do Not Exceed:

- a. 1/8" between adjacent floor elements in 10'-0" or 1/16" within width of a single unit.

C. Variation of Linear Building Line:

1. Position Shown in Plan and Related Portion of Columns, Walls, and Partitions: Do Not Exceed:

- a. 1/2" in any bay, maximum 20'-0".
- b. 3/4" in 40'-0" or more.

D. Variation in Cross-Sectional Dimensions:

1. Columns and Thickness of Walls, from Dimensions Shown: Do Not Exceed:

- a. Minus 1/4" nor plus 1/2".

E. Variation in Mortar Joint Thickness:

1. Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical information and instructions for each manufactured product prior to production.

B. Shop Drawings, Reinforcement: Submit shop drawings for fabrication, bending, and placement of wall reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures".

C. Samples: Submit the following samples:

1. Unit masonry samples for each type of exposed masonry unit required.
2. Anchors, Ties, Joint Reinforcement: Two (2) of each type proposed for use.

3. Mortar: Two (2) cured mortar samples matching Architect's color selection.

D. Certifications:

1. Mortar and Masonry Units: Submit copies of the manufacturer's written certification that the CMU and all components of the masonry mortar meet or exceed all the requirements set forth in this Section.
2. Grout Design Mix: Submit copies of the grout mix design. The grout for reinforced masonry walls shall be a pumpable, pea rock concrete mix with a minimum compressive strength of 2,500 psi at 28 days.
3. Reinforcing Steel: Submit mill certificates for all concrete reinforcing steel.

- E. Type "S" Mortar: Prior to construction, submit independent laboratory test results confirming the proposed mix design meets the requirements of ASTM C 270, Type "S" mortar. Average test results of a minimum of three samples shall have a compressive strength of 1,900 psi for a two-inch cube at 28 days.

F. Product Approval:

1. As applicable, products used herein shall comply with requirements of the Florida Product Approval System as required by Florida Statute 553.842 and Florida Administrative Code 9B-72.

1.06 PRODUCT DELIVERY AND STORAGE

- A. Deliver CMU, precast concrete formed units, and mortar materials to the Project site undamaged, on pallets, stacked to allow air circulation. Cover and protect from rain, ground water, soiling, staining, or intermixture with earth or other materials.
- B. Store mortar materials off the ground, under cover using tarpaulins, felt paper, or polyethylene sheets, and in a dry location. Remove damaged materials from the Project site and replaced at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS (CMU)

- A. CMU shall have nominal face dimensions of 16" long by 8" high by 8" wide (15-5/8" x 7-5/8" x 7-5/8" actual), unless otherwise indicated. Provide special shapes for lintels, corners, jambs, sash, control joints, headers and other special conditions.

- B. Minimum Thickness of Face Shells and Webs: Face shell thicknesses (FST) and web thicknesses (WT) shall conform with the following requirements, and in accordance with ASTM C 140:
1. Nominal 4 Inch Wide Units:
 - a. FST: 3/4 inch.
 - b. WT: 3/4 inch.
 - c. Equivalent WT: 1-5/8 inches.
 2. Nominal 6 Inch Wide Units:
 - a. FST: 1 inch.
 - b. WT: 1 inch.
 - c. Equivalent WT: 2-1/4 inches.
 3. Nominal 8 Inch Wide Units:
 - a. FST: 1-1/4 inches.
 - b. WT: 1 inch.
 - c. Equivalent WT: 2-1/4 inches.
- C. Hollow load-bearing CMU shall conform to ASTM C 90, Type II, pursuant to modifications in "Architectural Concrete Masonry Units in Florida" published by the Florida Concrete and Products Association.
1. Weight Classification: Normal weight.
- D. Hollow non-load-bearing CMU shall conform to ASTM C 129.
- E. CMU for exposed conditions shall have length and height tolerances which do not exceed 1/16" +/- (a total not to exceed 1/8"). In locations where both sides are exposed, the width tolerances shall be 1/32" +/- in thickness (a total not to exceed 1/16").
- F. Performance Requirements: General: After 28 days from the time of manufacture, CMU shall conform to the strength and absorption requirements specified herein. The 28 day time period shall include a minimum of 7 days prior to delivery to the project site.
1. Compressive Strength: CMU shall have the following minimum compressive strengths for the average net area:
 - a. Average of 3 Units: 2800 psi.
 - b. Individual Unit: 2500 psi.

2. Water Absorption: The maximum water absorption (average of 3 units) shall be 10 lb/cf for normal weight units with an oven dry weight of concrete of more than 128 lb/cf.

2.02 PRECAST CONCRETE FORMED UNITS

- A. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast fabricator's option.
- B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project, complying with ACI 318 "Building Code Requirements for Reinforced Concrete".
- C. Mix shall be standard-weight concrete consisting of ASTM C 150, Type I or Type III portland cement, ASTM C 33 hard, durable, silica aggregate free of material that causes staining, admixtures, and potable water to produce the following properties:
 1. Compressive Strength: 3,400 psi at 28-days.
 2. Total Air Content: Not less than 4-percent nor more than 6-percent.
 3. Water Absorption: Not to exceed 5 to 6-percent by weight, except between 3 to 4-percent for sloping surfaces (sills).
 4. Color: "Grey".

2.03 JOINT REINFORCEMENT

- A. Material:
 1. Exterior CMU Reinforcement: 9 gauge cross rods; all other 3/16 inch, unless otherwise recommended in the manufacturer's published literature.
 2. Interior CMU Reinforcement: 9 gauge edge rods.
- B. Size: 2 inch less width than wall.
- C. Finish: Hot dip galvanized (1.5 oz. coating) after fabrication. ASTM A 153, Class B-2.
- D. Products for Single Wythe Walls. Provide one of the following:
 1. "Dur-O-Wal Truss"; Dur-O-Wal, Inc.

2. "Lox All Truss-Mesh #120"; Hohmann & Barnard, Inc.
 3. "Truss"; National Wire Products Industries.
- E. For Corners and Intersections: Use prefabricated corners and tees.

2.04 MORTAR MATERIALS

- A. Portland Cement: Comply with ASTM C 150, Type I, non-staining, without air entrainment and of natural color.
- B. Hydrated Lime: Comply with ASTM C 207, Type S.
- C. Sand: Comply with ASTM C 144, hard, free of clay, loam, dust or organic matter.
- D. Water: Comply with ASTM C 270, clean and free of deleterious materials which would impair the strength or bond. Sea water or water containing salts shall not be used.
- E. Masonry Cement: Comply with ASTM C 91.
 1. For pigmented mortar, use a colored cement formulation as required to produce the color indicated or, if not indicated, as selected from manufacturer's standard formulations.
 2. Products: Provide one of the following colored masonry cements:
 - a. "Magnolia Masonry Cement"; Blue Circle Cement.
 - b. "Centurion Colorbond"; Lafarge Corporation.
 - c. "Richcolor Masonry Cement"; Southdown, Inc.

2.05 GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, unless otherwise acceptable to the Architect. Use one brand of cement throughout the Project.
- B. Aggregates for Grout: Comply with ASTM C 404. Provide size No. 89 aggregate for coarse grout.
- C. Fly Ash: ASTM C 618, Type "F".
- D. Air Entraining Admixtures: The use of air-entraining admixtures is not permitted for grout.
- E. Water Reducing Admixture: ASTM C 494, Type "A", containing not more than 0.1% chloride ions.

- F. High Range Water Reducing Admixture (Super Plasticizer): ASTM D 495, Type "D", containing not more than 0.1% chloride ions.
- G. Calcium chloride or admixtures containing more than 0.1% chloride ions are not permitted. Provide admixtures manufacturer's written certification that the chloride ion complies with specified requirements.
- H. Water: Potable.

2.06 MISCELLANEOUS MATERIALS

- A. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60.
- B. Preformed Control Joint Gaskets: Styrene-butadiene rubber compound conforming to ASTM D 2000, Designation 2AA-805, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as recommended for wall as indicated. Provide maximum horizontal spacing of vertical control joints as follows:
 - 1. Exterior Walls: For walls with horizontal joint reinforcing 16 inches o.c., space vertical control joints not more than 26 feet o.c.

2.07 MIXING MORTAR

- A. Mortar shall meet requirements of ASTM C 270 Type S mortar.
- B. Mortar mixes with proportions, measured by volume, for unit masonry work shall be one of the following, at the Contractor's option:
 - 1. 1 part masonry cement, 4-1/2 parts sand (maximum), and 1/2 part portland cement.
 - 2. 1 part portland cement, 1/4 to 1/2 part hydrated lime, and 4-1/2 parts sand (maximum).
- C. The freezing point of the mortar shall not be lowered by use of admixtures or anti-freeze agents.
- D. The mortar mix shall comply with ASTM C 270, except materials shall be limited to those specified herein, and cement/lime ratio shall be not more than 1/2 part lime per part of portland cement.
- E. Cement setting bed shall be 1 part portland cement with 2 parts damp setting bed sand, with water to dampen sand, if required, but not added to the mix.
- F. Mixing shall be performed in a machine mixer for a minimum of 5 minutes with sufficient

water to produce a workable mix. Each batch shall have 1 or more full bags of cement. Colored mortar shall use complete contents of measured container.

- G. Measure shall be by volume in buckets or boxes. Measure by shovel is not acceptable.
- H. Mortar shall be used within 2 hours after mixing. Re-tempering shall be permitted within two hours, maximum. Re-tempering shall only be allowed once per batch. Re-tempering of colored mortar shall not be permitted. Contractor shall note that additional water may cause significant lightening of the mortar.
- I. Mortar shall not be deposited on or permitted in contact with the ground.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine the area and conditions under which unit masonry will be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Walls shall be laid out in advance to accurately and properly locate openings, movement-type joints, returns and offsets. The use of less-than-half-size units at corners and jamb shall be avoided. The walls shall be laid-up plumb in a full bed of mortar with full head joints pushed, not slushed. Evidence of slushing shall require installer to rebuild the walls. Units shall be laid true with all courses level. Units shall be cut with a masonry saw, not broken. Abutting walls shall be bonded together at alternate courses.
- B. Provide running bond pattern, unless otherwise indicated on Drawings.
- C. All joints shall be tooled concave except as follows:
 - 1. Joints shall be flush with units in walls to receive tile work.
 - 2. Joints to receive sealants shall have mortar raked out 1/2 inch deep. Jointing shall measure 3/8 inch wide, normally, including those around interior door frames.
- D. Units disturbed after laying shall be removed, cleaned, and re-laid in fresh mortar. If adjustments are required, masonry units shall be removed, cleaned of mortar, and reset in fresh mortar.
- E. Masonry work shall be stopped only by raking (stepping) back 1/2 masonry unit increments in each course. Grout pours shall be stopped 4 inches below tops of units. Prior to resuming work, loose units and unbonded mortar shall be removed.

- F. Units shall be laid in alignment on face primarily exposed to view. If both faces are exposed, the Architect shall be consulted as to which face to favor. Favored or exposed walls shall be laid from that side only.
- G. Items specified under other Sections shall be built-in as the work progresses.
- H. Beginning at the lowest multiple of 16 inches, wall steel reinforcing shall be placed in bed joints 16 inches on centers and where otherwise noted on drawings, with 8 inch laps at splices and bed corners.
- I. Hollow metal frames abutting masonry and concrete shall be grouted solid allowing for joint for sealant between frame and masonry unit.
- J. Masonry units shall not be laid when the mean temperature is 40 degrees F or below. Minimum temperature of units when laid shall be 35 degrees F.

3.03 PROTECTION

- A. Partially completed masonry shall be protected against the weather, when work is not in progress, by covering the tops of walls with strong, waterproof, non-staining membrane extending at least 2'-0" down both sides of walls and held securely in place. Unbraced walls shall be properly braced against lateral forces.
- B. Exposed masonry surfaces shall be protected against staining. Misplaced mortar shall be removed immediately.

3.04 LINTELS

- A. Provide masonry lintels where shown and wherever openings of more than 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.05 LOW-LIFT GROUTING

- A. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcing and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
2. Place vertical reinforcement before grouting. Tie vertical reinforcement to dowels at base of masonry and thread CMU over or around reinforcement.
3. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 4'-0". Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.
 - a. Place grout in lintels or beams over openings in one continuous pour.
4. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2 inches of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequences if more pours are required.

3.06 REPAIR, POINTING AND CLEANING

- A. Mixers, boxes and all tools shall be cleaned with a forceful spray of water and hand scrubbing after each use and at the end of each day.
- B. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- C. Pointing: During the tooling of joints, enlarge all voids or holes, except weep holes, and completely fill with mortar, striking surface flush with minimal smearing of mortar adjacent to patch. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of joint sealants.
- D. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Comply with recommendations in NCMA TEK Bulletin No. 8-2 - Removal of Stains from Concrete Masonry Walls.

3.07 QUALITY CONTROL TESTING DURING CONSTRUCTION OF GROUT (CONCRETE CELL FILL)

- A. General: The Owner will employ a testing laboratory to perform tests and to submit test reports.

- B. Sampling and Testing Fresh Grout: ASTM C 1019, except modified for slump to comply with ASTM C 94.
1. 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. Specified slump for grout shall be in accordance with ACI 530-4.2.2.2; "Desired consistency of grout shall be considered achieved when slump falls between 8 and 11 inches."
 2. 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.
 3. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F and below, when 90 degrees F and above, and one test for each sample of compressive-strength specimens.
 4. Compression Test Specimen: Three specimens shall constitute one sample to be tested at each age of test; one set of 4 standard samples for each compressive strength test, unless otherwise directed. Mold and store specimens for laboratory-cured testing except when field-cure test specimens are required.
 5. Compressive Strength Tests: One set of 4 standard samples for each day's pour exceeding 5 cu. yds. plus additional sets for each 50 cu. yds. more than the first 25 cu. yds. of each concrete class placed in any one day; one sample tested at 7 days, two samples tested at 28 days, and one sample retained in reserve for later testing if required.
 6. 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 Architect, Ready-Mix Producer, and Contractor within 24 hours after tests. 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 tests 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 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. Contractor shall pay for such tests when unacceptable concrete is verified.

3.08 QUALITY CONTROL TESTING DURING CONSTRUCTION OF BLOCK, MORTAR OR BLOCK/MORTAR ASSEMBLAGE

- A. The average moisture content of individual CMU shall be limited to 25% saturation during delivery, storage, and installation. A minimum of three representative, randomly chosen blocks for every 5,000 sq. ft. of wall shall be sampled, tested, and reported by methods complying with ASTM C 140.
- B. The average compressive strength of individual CMU shall be in accordance with Paragraph 2.02, F. "Performance Requirements" of this specification. A minimum of three representative, randomly chosen blocks for every 5,000 sq. ft. of wall shall be sampled, tested, and reported by methods complying with ASTM C 140. Individual blocks used in moisture content tests shall not be used for compressive strength testing. Sampled units destined for compressive strength testing shall be maintained in their "as-received" condition until testing.
- C. The average compressive strength of concrete masonry unit prisms (one or more masonry units mortared on top of another) shall be 1,500 psi at 28 days. A minimum of three prisms for every 5,000 sq. ft. of wall shall be constructed, tested and reported by methods complying with ASTM E 447, Method "B". The method of constructing, curing, and testing of prisms shall not vary throughout the project.
- D. Perform quality control tests on mortar complying with ASTM C 780 for every 500 sq. ft. of wall placed.

END OF SECTION

DIVISION 05
METALS

SECTION 05500

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

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

1.02 RELATED WORK

- A. Section 03010 – Concrete Work
- B. Division 11 - Equipment

1.03 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.

1.04 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

1.05 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.

1.06 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

2.01 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 AA-C22-A41 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

2.02 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.

2.03 ALUMINUM GRATING

- A. Unless noted otherwise, grating shall have rectangular, 3/16-in minimum thickness, bearing bars spaced at 4-in on center. All grating panels shall be banded with a bar the same size as the bearing bars.
 - 1. Grating shall not exceed the fabricator's maximum recommended span, and meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.
 - a. The grating shall produce a deflection of 1/360 of the span or less under a uniform live load of 100 lbs/sq ft on the maximum span.
 - b. The grating shall produce a deflection of 1/360 of the span or less under a concentrated live load of 300 lbs applied at the mid point of the maximum span.
 - 2. Openings 2-in or greater in diameter/dimension and grating edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.
 - 3. Provide trench grating with symmetrical cross bar arrangement.
 - 4. Grating clamps, nuts, bolts, washers and other fastening devices for grating and grating supports shall be Type 316 stainless steel. Anchor blocks, when used, shall be of the same material as the grating. All grating shall be anchored to the supporting system using saddle clips.
- B. Aluminum grating material shall be aluminum alloy 6063-T6 with a mill finish. Cross bars shall be attached to the bearing bars with interlocked swaged joints. The

grating shall be Type BS by IKG Borden, Houston, TX; Type 19 SG-4 by Ohio Gratings, Inc., Canton, OH; type 19S4 by Seidelhuber Metal Products, San Carlos, CA or equal.

- C. Steel grating material shall conform to ASTM A570, Grade 36 or ASTM A36, galvanized. Cross bars shall be attached to the bearing bars by welding or with interlocked swaged joints. Grating with cross bars pressed into notches in the top of the bearing bars will not be acceptable. Grating shall be hot-dipped galvanized finish complying with the requirements of ASTM A123, however, the average minimum weight of the zinc coating shall not be less than 2 oz/sq ft.
- D. Metal frames and supports for grating shall be of the same material as the grating unless otherwise shown on the Drawings. Where aluminum supports are used, they shall be fabricated from aluminum alloy 6061-T6.

2.04 RAILINGS

- A. Railing systems (handrail and guardrail) shall comply with the requirements of OSHA and Florida Building Code.
- B. Aluminum railing systems shall be a welded or mechanically fastened, seamless, extruded aluminum pipe system. Rails shall be 6063-T6 alloy. Posts shall be 6061-T6 alloy. Splice and reinforcing sleeves, brackets, end caps, toeboards, etc., shall be aluminum alloy 6063-T6 or 6061-T6. Cast fittings shall be aluminum alloy No. 214. Railing system fastening hardware shall be Type 316 stainless steel. Aluminum shall have a mill finish, except as otherwise specified.
- C. Railings shall be as shown on the Drawings, fabricated with 1-1/2-in nominal diameter pipe. Posts shall be Schedule 80 pipe minimum and rails and handrails shall be Schedule 40 pipe minimum. Posts and top rails shall be continuous. Spacing of posts shall not exceed 5-ft on center and shall be uniformly spaced except as otherwise shown on the Drawings. All railing posts shall be vertical.
- D. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Welding methods shall be in conformity with AWS standards for the materials being joined. All rails to post connections shall be coped and fastened by continuous welds. There shall be no burrs, sharp edges or protrusions on any weld on any part of the handrail system. After fabrication, the welds and surrounding area shall be cleaned and hand buffed to blend with the adjacent finish. All mechanical fasteners shall be unobtrusively located in countersunk holes with the top flush with the surface of the rail. Bends in the railing shall be as indicated by the Drawings. No distortion of the circular railing shape will be allowed. Bends and terminal sections shall be made without the use of fittings. Corner bends shall be mitered and welded bends.

- E. Railing shall be assembled in sections as long as practical but shall not be greater than 24-ft in length. A field splice shall be used when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure expansion joints.
 - 1. Field splices shall use internal splice sleeves located within 8-in of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.
 - 2. When the field splice occurs in a railing panel crossing a structure expansion joint, the sleeve shall be welded to the rail on one side and be free to slide in the rail on other side. The field splice shall be detailed to take the same movement as the structure expansion joint.

- F. The bases or supports for railing posts and handrail shall be the types indicated on the Drawings.
 - 1. Where non-removable railing is set in concrete, the posts shall be placed in 2-1/2 in diameter formed concrete openings and firmly caulked with non-shrink nonmetallic grout. Collars shall be placed around the post bases and fastened in place with set screws on the side of the post away from the walkway. Posts shall be placed with the centerline 4-in from the edge of the concrete except that posts shall be set at the centerline of concrete curbs.
 - 2. Where handrail is to be fastened to walls, the rails shall be provided with screwed wall flanges fastened to the walls with three 3/8-in stainless steel flat head machine screws.

- G. Safety gates, for railing openings, shall be fabricated of matching pipe and rail material and configuration. The gates shall be self-closing gates with approved stop, latch and stainless steel closure spring and hinges.

- H. Barrier chains, for railing openings, shall be fabricated of stainless steel chains. Chain shall be 1/4-in stainless steel links, with eleven links per foot as manufactured by Eastern Chain Works, Inc., NY; Lawrence Metal Products, Inc., or equal. Chains shall be fastened to the handrail posts with a 1/4-in diameter stainless steel eye bolt and the other end shall be connected to the other post by means of a heavy chromium plated bronze swivel eye slide harness snap and a similar eye bolt.

- I. Toeboards shall be provided on all railing adjacent to a drop in elevation of 4-ft or more. Toeboards are not required on the inclined portion of stairway railings or where concrete or steel curbs, 4-in or more in height, are present. Toeboards shall be

4-in high plate with a minimum thickness of 1/4-in. Toeboards shall be positioned with a maximum clearance of 1/4-in from the floor and fastened to railing posts with 1/4-in stainless steel U-bolts, with J-bolts at corner posts and with clip angles and two 1/4-in stainless steel expansion bolts at walls.

- J. All railings shall be properly protected by paper, or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed. After protective materials are removed, the surfaces shall be made clean and free from stains, marks, or defects of any kind.
- K. Access hatches shall have single or double leaf doors as indicated by the Drawings. The doors shall be 1/4-in aluminum diamond pattern plate with welded stiffeners, as necessary, to withstand a live load of 300 lbs/sq ft with a maximum deflection of 1/150th of the span. Hatches shall have a 1/4-in aluminum channel frame with a perimeter anchor flange or strap anchors for concrete embedment around the perimeter. Unless otherwise noted on the Drawings, use pivot torsion bars for counterbalance or spring operators for easy operation along with automatic door hold open. Hardware shall be durable and corrosion resistant with Type 316 stainless steel hardware used throughout. Provide removable lock handle. Finish shall be the factory mill finish for aluminum doors and frames with bituminous coating on the exterior of the frames in contact with concrete. Access hatches shall be Type J aluminum by Bilco Company, New Haven, CT or equal.
- L. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8-in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 316 stainless steel. Plates shall have a mill finish.
- M. Stair treads for aluminum stairs shall have abrasive non-slip nosing as approved.
- N. Aluminum nosing at concrete stairs shall be Wooster Products, Inc.; Alumogrit Treads, Type 116; similar by Barry Pattern and Foundry Co.; Andco or equal. Furnish with wing type anchors and flat head stainless steel machine screws, 12-in on center. Nosing shall also be used at concrete ladder openings. Nosing shall a single piece for each step extending to within 3-in at each side of stair or full ladder width. Set nosing flush with stair tread finish at concrete stairs. Furnish treads with heavy duty protective tape cover.

2.05 MISCELLANEOUS STAINLESS STEEL

- 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. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. [Grind smooth continuous welds that will be exposed.] Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

2.06 MISCELLANEOUS ALUMINUM

- 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. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of wells shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.
- D. Angle frames for hatches, beams, grates, etc., shall be complete with welded strap anchors attached.

PART 3 - EXECUTION

3.01 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.

3.02 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 batch 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.

3.03 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. 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



SECTION 09703

PROTECTIVE COATINGS

PART 1 GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, materials, and equipment to apply a cured in place fiberglass liner system to the influent structure channels (walls and bottom) and drain pump station interior walls and bottom.
- 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 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 to 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.
- E. The Specified System is the minimum standard of quality for this project. Alternative manufacturers shall be submitted per Section 01600, Materials and Equipment, 1.05, Substitutions and Product Options.

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 protective liner shall be by the PerpetuWall Liner System (PLS-650) as manufactured by Protective Liner Systems, Inc. (PLS), or approved equal.
- 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:

PROPERTY	TEST METHOD	RESULTS
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.

3.02 SAFETY INSPECTION

- A. Evaluation of Atmosphere: Prior to entering structures, an evaluation of the atmosphere will be conducted to determine the presence of toxic, flammable vapors or possible lack of oxygen. The evaluation shall be in accordance with local, state or federal safety regulations.

3.03 CLEANING

- A. Place covers over all pipe openings to prevent extraneous material from entering the sewer system. All foreign material shall be removed from the structures' wall and floors using a pressure water spray (minimum 2500 psi). The use of acid for cleaning purposes, no matter how dilute, will not be allowed.

3.04 SURFACE PREPARATION

- A. In addition to the aforementioned preparations, all dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces, which are to be coated.
- B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in contact with painted surfaces and not to be painted shall be masked or otherwise protected prior to surface preparation and painting operations.
- C. Before commencing work, the painter must make certain that surfaces to be covered are in perfect condition. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the Engineer. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter shall

be held responsible for the results reasonably expected from the materials and processes specified.

- D. Program the cleaning and painting so contaminants from the cleaning process shall not fall onto wet, newly painted surfaces.
- E. Prepare cementitious surfaces of concrete, concrete block, and cement plaster to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
- F. Clean ferrous substances, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning. All welds, blisters, etc., shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting.
- G. Surface profile as obtained from sandblasting shall be as recommended by the coating manufacturer.
- H. Surfaces not to be coated, such as grating seats, new FRP stop gate guides, comminutor supports, and bar screen supports shall be protected from coating repairs.
- I. Overspray of any items not specified to be coated shall be removed at the Contractors' expense to the satisfaction of the Engineer.

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. 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.
- C. 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.
- D. 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.

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 protective liner system has been properly applied.

END OF SECTION

SECTION 09900

HEAVY DUTY FINISHES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all materials, labor equipment, and incidentals required to provide a protective coating system for the surfaces listed herein and not otherwise excluded.
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces such as concrete, miscellaneous metal, posts, bollards, pipes, fittings, valves, equipment, and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the schedule of work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specifications as stated herein.
- C. "Paint" as used herein means all coating systems, materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- D. The following items shall not be painted:
 - 1. Any code requiring labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
 - 2. Any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated.
 - 3. Aluminum grating.
 - 4. Stainless steel
 - 5. Products with polished chrome, aluminum, nickel or stainless steel finish.
 - 6. Flexible couplings lubricated bearing surfaces, insulation and metal and plastic pipe interiors.
 - 7. Signs and nameplates.

8. Any packing glands, unless otherwise indicated.
 9. Surfaces coated with cementitious coating.
- E. The influent structure / headworks flow channels and interior drain pump station walls shall be coated in accordance with Section 09703.

1.02 RELATED WORK

- A. Division 11 – Equipment
- B. Division 15 – Mechanical
- C. Division 16 - Electrical

1.03 SUBMITTALS

- A. Provide manufacturer's data and samples as indicated below in accordance with Section 01340 – Shop Drawings, Project Data and Samples.
- B. Samples - Painting
 1. The Owner shall select paint colors. Compliance with all other requirements is the exclusive responsibility of the Contractor.
 2. Samples of each finish and color shall be submitted to the Engineer for approval before any work is started.
 3. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where 3 coat work is specified, the sample shall be divided into 3 areas - one showing the application of one coat only, one showing the application of 2 coats and one showing the application of all three coats.
 4. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.
 5. For piping, valves, equipment and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish and general characteristics.
 6. Rejected samples shall be resubmitted until approved.

1.04 REFERENCE STANDARDS

- A. NACE, National Association of Corrosion Engineers
- B. ASTM, American Society of Testing and Materials
- C. SSPC, Steel Structures Painting Council

1.05 QUALITY ASSURANCE

- A. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product shall not be acceptable. Brand identification is keyed to products of Tnemec Co., Inc., Kansas City, MO, to establish standard of quality or approved equal.
- B. Provide an undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.
- C. Undercoat and finish coat paints shall be compatible.
- D. Painting shall be accomplished by experienced painters specializing in industrial painting familiar with all aspects of surface preparations and applications required for this project.

1.06 SYSTEM DESCRIPTION - NOT USED

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label.
 - 1. Provide labels on each container with the following information:
 - a. Name or title of material
 - b. Federal specification number if applicable
 - c. Manufacturer's stock number and color
 - d. Manufacturer's name
 - e. Generic type

- f. Contents by volume, for major pigment and vehicle constituents
 - g. Application instructions
2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps that should be taken to prevent injury to those handling the product.
- B. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.
 - C. The Engineer shall designate areas for storage and mixing of all painting materials. Comply with the requirements of pertinent codes and fire regulations. Proper containers outside of the building shall be provided by the Contractor and used for painting wastes. No plumbing fixtures shall be used for this purpose.
 - D. Used rags shall be removed from the buildings every night and every precaution taken against spontaneous combustion.

1.08 PROJECT/SITE REQUIREMENTS - NOT USED

1.09 MAINTENANCE - NOT USED

1.10 WARRANTY

Comply with provisions of Section 01740.

1.11 DEFINITIONS - NOT USED

1.12 INSTALLATION, OPERATION AND MAINTENANCE MANUAL – NOT USED

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All paint shall be manufactured by one of the following and shall be their highest grade of paint: Tnemec, Koppers, Ameron, Porter, or Rustoleum. Requests to use other paint manufacturers and materials other than specified shall be submitted to the Engineer for approval.
- B. The following coating systems list a product by name to establish a standard of quality; other products of the same generic types may be submitted to the Engineer for approval. When other than the specified coating system is proposed, the

Contractor shall submit a typewritten list giving the proposed coatings, brand, trade name, generic type and catalog number of the proposed system for the Engineer's approval.

- C. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint.
- D. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.
- E. Finish coats containing lead shall not be allowed. Oil shall be pure boiled linseed oil.
- F. Rags shall be clean painters' rags, completely sterilized.

2.02 SHOP COATINGS

- A. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish paints to be used. The Contractor shall coordinate and ascertain such compatibility with his subcontractors and suppliers.
- B. No paint containing lead shall be allowed.

2.03 COATING SYSTEMS

- A. Concrete (Structure walls, beams, columns, floors, etc. excluding the influent structure channels and drain pump station walls)

Exposed concrete surfaces of the new influent structure not subjected to wastewater, nor included in other coating systems and shall include the following surfaces:

- 1. Surfaces to Be Coated
 - a. Exterior exposed cast-in-place concrete surfaces.
- 2. Class 1 Coating System
 - a. Surface Preparation - Fill cracks, voids and other surface imperfections. Remove mortar droppings.
 - b. Primer
 - Concrete or Stucco - None
 - Concrete Block - Block Filler

Cementacious Acrylic
(100 square feet per gallon)
(Tnemec Series 130-6602 Envirofill)

- c. First Coat
Acrylic Emulsion White Tinting Base
(4 mils)
(Tnemec Series 180 W.B. Tnemec - Crete)
- d. Second Coat
Acrylic Emulsion White Tinting Base
(4 mils)
(Tnemec Series 180 W.B. Tnemec - Crete)
Exterior colors factory mixed

B. Metal (Non-submerged Exterior and Interior) (Urethane)
Exterior and interior metal surfaces and shall include the following:

- 1. Surfaces to Be Coated
 - a. Pumps
 - b. Aboveground piping
 - c. Miscellaneous steel shapes, angles, etc.
 - d. Conduit
 - e. Electrical equipment
- 2. Coating System
 - a. Surface Preparation - Sandblast clean to near white metal (SSPC-SP10). Hand or power tool clean items are not suitable for sandblast cleaning. All metal surfaces shall be completely degreased by solvent cleaning in compliance with SSPC-SP1.
 - b. Prime Coat
Epoxy (3 mils dry) Tnemec Series 66-1211 Epoxoline
New Galvanized Surfaces - SSPC-SP1 Solvent Cleaning
Tnemec Series 66-1211 Epoxoline Primer
 - c. Intermediate Coat
66-color Hibuild EP
(3 mils)

- d. Finish Coat
Aliphatic Polyurethane - Tnemec Series 74 Color Endura
Shield (2.5 mils dry)
(Colors - as selected by Engineer; provide 3 colors plus
Manufacturer's Standard Colors Selection)

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. In addition to the aforementioned preparations, all dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces, which are to be coated.
- B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in contact with painted surfaces and not to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations.
- C. Before commencing work, the painter must make certain that surfaces to be covered are in perfect condition. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the Engineer. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter shall be held responsible for the results reasonably expected from the materials and processes specified.
- D. Program the cleaning and painting so contaminants from the cleaning process shall not fall onto wet, newly painted surfaces.
- E. Prepare cementitious surfaces of concrete, concrete block, and cement plaster to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
- F. Clean ferrous substances, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning. All welds, blisters, etc., shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting.
- G. Surface profile as obtained from sandblasting shall be as recommended by the coating manufacturer.

3.2 MATERIALS PREPARATION

- A. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt and other foreign materials.
- B. No thinners shall be used except those specifically mentioned and only in such quantity as directed by the manufacturer in his instructions. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or cleanup solvent shall be used for all clean up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

3.3 APPLICATIONS

- A. Color Selection
 - 1. Color - All colors shall be selected by the Owner with direction from the Engineer.
- B. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.
- C. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.
- D. All paint shall be at room temperature and the surface to be painted shall be dry and clean.
- E. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint is of uniform finish, color and appearance.
- F. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps and brush marks. Each coat shall be applied in a manner that shall produce an even film of uniform and proper thickness.
- G. Paint surfaces behind moveable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
- H. Paint backsides of access panels and removable or hinged covers to match the exposed surfaces.
- I. Finish exterior doors on tops, bottoms, and sides edges the same as the exterior faces, unless otherwise indicated.

- J. Sand lightly between each succeeding enamel or varnish coat.
- K. Omit the first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise specified.
- L. Retouching Existing Painted Surfaces - Existing painted surfaces damaged by the modification work or other operations of the Contractor shall be retouched to conform to the above coating systems and blend in with the new and existing work. Damaged surfaces shall be repainted with not less than 2 coats, and other existing surfaces that are listed shall be repainted with the coating system specified.
- M. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coat or coats. Such items as pumps, motors, equipment, electrical panels, etc. shall be given at least one touch-up coat with the intermediate coat material and one complete finish coat in the field.

3.4 APPLICATION RESTRICTIONS

- A. Application of materials shall be done only on properly prepared surfaces as herein specified, and all exterior painting shall be done only in dry weather. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Engineer.
- B. In no case shall paint be applied to surfaces that show a moisture content greater than 15 percent.

3.5 MINIMUM COATING THICKNESS

- A. Coatings shall be applied in accordance with the manufacturer's recommendations.
- B. Apply a prime coat to material, which is required to be painted or finished, and which has not been prime-coated by others.
- C. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

3.6 FINISHES

- A. Pigmented (Opaque) Finishes - Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections shall not be acceptable.

- B. Complete Work - Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specific requirements.

3.7 FIELD QUALITY CONTROL

- A. The Engineer shall check all completed surfaces and the Contractor shall provide the necessary properly calibrated gauges. All non-ferrous surfaces shall be checked for number of coats and thickness by use of a Tooke gauge. All ferrous surfaces shall be checked for film thickness by use of an Elcometer or Micro-Test magnetic dry film gauge properly calibrated. In addition, submerged tank linings and metals shall be tested for freedom from holidays and pinholes by use of a Tinker-Razor Holiday Detector. All defects shall be corrected to the satisfaction of the Engineer.

3.8 PROTECTION

- A. All surfaces shall be protected while painting equipment, piping, etc.
- B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery nameplates and all machined parts not to receive paint. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage.

3.9 CLEANING

- A. The Contractor shall perform the work under this Section while keeping the premises free from accumulation of debris and rubbish and shall remove all scaffolding, paint cloths, paint, and brushes from the building when completed.
- B. Cleaning - All paint brushed, splattered, spilled or splashed on any surface not specified to be painted shall be removed.

3.10 EXTRA STOCK

- A. Paint to be supplied to Owner - Upon completion of painting work, the Owner shall be furnished, at no additional cost, one gallon of each type and color of finish paint for touching up. Paint container labels shall be complete with manufacturer's name, generic type, number, color, and location where used.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11295

COPLASTIX STOP, SLIDE AND WEIR 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 stop, slide and weir 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.
- B. The Contractor shall furnish all labor, materials, equipment, and incidentals required, consisting of, but not limited to frames, discs, seals, stems, operators, floor stands, stem guides, anchorage, and all other appurtenances, and install complete and ready for operation all gates and appurtenances as shown on the Drawings and as specified herein.
- C. 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.
- D. The equipment shall include, but is not be limited to, the following Schedules:

Weir Gate Schedule					
No.	Location	Type	Size (WxH) (ft)	Mounting	Seating Head (ft)
1	Headworks	Slide – Down Opening	8 x 2	Face-Mount	<10
2	Headworks	Slide – Down Opening	6 x 2	Face-Mount	<10
3	Headworks	Slide – Down Opening	5 x 2	Face-Mount	<10

Slide Gate Schedule					
No.	Location	Type	Size (WxH) (ft)	Mounting	Seating Head (ft)
8	Headworks	Upward Opening	4 x 5	Wall-Mount	<10
9	Headworks	Upward Opening	4.5 x 5	Wall-Mount	<10
10	Headworks	Upward Opening	2 x 2	Wall-Mount	<10

Stop Gate Schedule					
No.	Location	Type	Size (WxH) (ft)	Mounting	Seating Head (ft)
11	Headworks	Upward Opening	5 x 4	Wall-Mount	<10
12	Headworks	Upward Opening	6 x 11.5	Wall-Mount	11.5
13	Headworks	Upward Opening	8 x 7	Wall-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 slide and weir 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 slide and weir 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 slide and weir 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 slide and weir 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 stop, slide and weir 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:

Stop, slide and weir gates shall be designed for the seating and unseating heads as listed in the gate schedules. Slide and weir 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 slide and weir gates shall be installed and operated.

- A. Reinforced Plastic Stop, Slide and Weir 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 ⁶ erg
Water Absorption	0.38 %
Specific Gravity	1.72
Coefficient of Thermal Expansion	1.6 x 10 ⁻⁵ 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 slide and weir 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.

2.04 MOTOR OPERATORS:

The new slide and weir gate motor operators shall be Auma Actuators, Inc., electric motor operators, specifically designed for the intended service. Each electric motor operator shall be rated for 480 volt, 3 phase electric service, and shall be equipped with an integral disconnect switch, control power transformer, mechanically and electrically interlocked reversing motor starter, Open/Stop/Close pushbuttons, pad lockable Local/Remote selector switch, auxiliary DPDT full open limit switches, auxiliary DPDT full closed limit switches, and strip heaters in both the motor and limit switch compartments. Electric motor operators shall be NEMA 4X construction with TEFC motors; electric motor operators to be located within classified areas shall be explosion proof construction.

PART 3 – EXECUTION

3.01 INSTALLATION

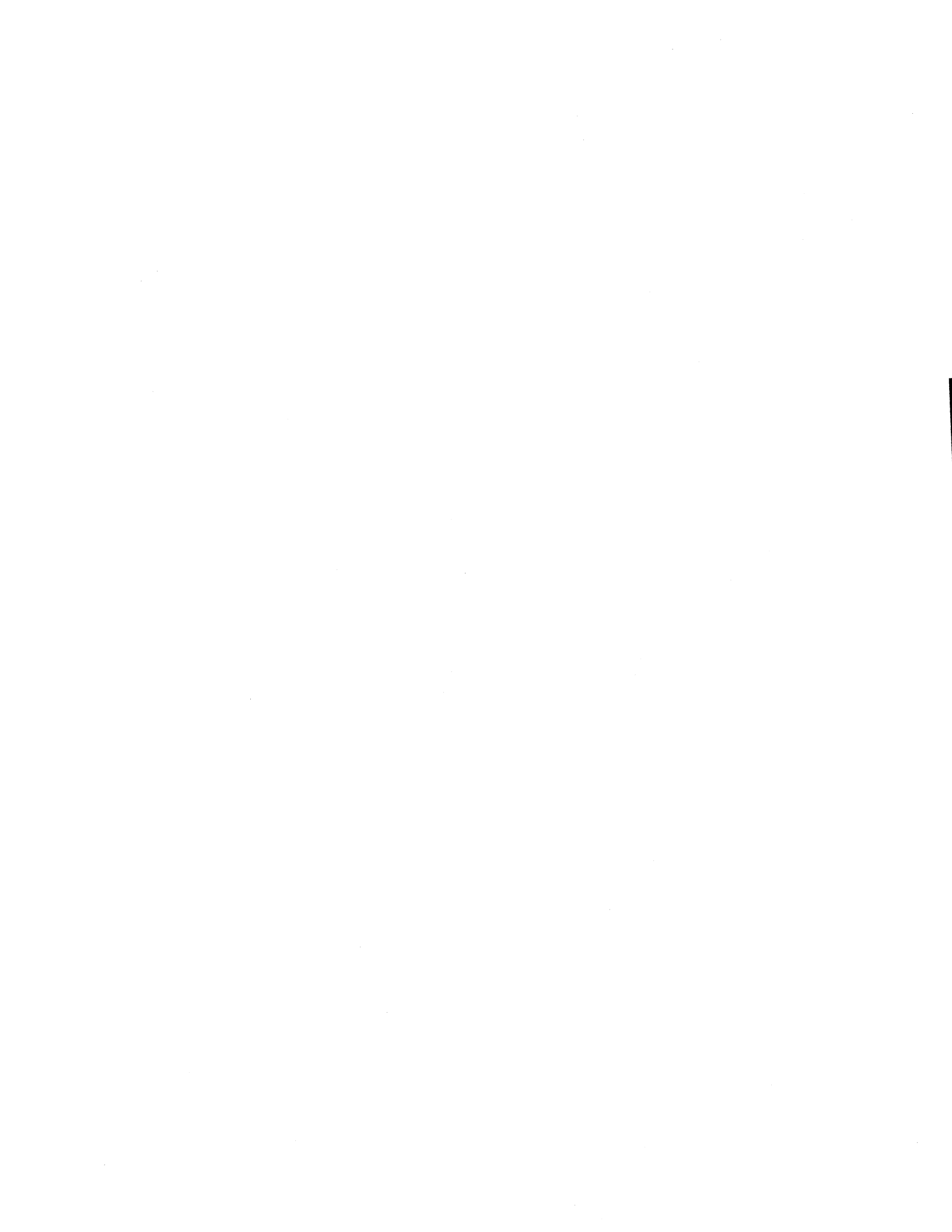
Installation of all gates and guides shall be done by the Contractor in a manner acceptable to the Manufacturer and Owner. It shall be the responsibility of the Contractor to handle,

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



SECTION 11310

GRIT REMOVAL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. The Contractor shall furnish and install 1 grit removal, washing and dewatering system to handle a maximum peak flow of 22.5 mgd. The Contractor shall provide all materials, equipment and incidentals required to furnish, transport, and place into operation the grit removal, washing, and dewatering system. The system must be complete and operational with motors, base plates, control equipment and accessories as shown and specified in this section.
- B. The Contractor shall have overall system responsibility for coordination of all major components of the system. Overall system responsibility shall include start-up, training, calibration, and overall successful operation of the equipment. The grit removal, washing, and dewatering system shall be supplied by a single supplier to ensure coordination and compatibility of equipment.
- C. The device shall be capable of removing grit from the wastewater and depositing the grit in the grit hopper. The grit removal and storage device shall have no moving parts. Rotating turbines, blades, or submerged bearings are not acceptable.

1.02 RELATED WORK

- A. Section 03310 - Concrete Work
- B. Section 05500 - Miscellaneous Metals
- C. Section 11314 - Recessed Impeller Pumps
- D. Division 16 - Electrical

1.03 SYSTEM DESCRIPTION

- A. The Grit Removal, Washing, and Dewatering System shall include one (1) Headcell Settleable Solids Concentrator units, one (1) Slurrycup Grit Separation/ Classification unit, one (1) Grit Snail Grit Dewatering Escalator unit, and one (1) control panel.
- B. Each Headcell unit will be placed in the concrete influent / headworks structure. The grit pump shall remove and discharge the settled grit from the Headcell to the Grit

Separation/Classification unit. The Grit Separation/Classification unit will be placed above the Grit Dewatering Escalator unit to allow the settled grit from the Grit Separation/Classification unit to empty into the hopper of the Grit Dewatering Escalator unit where it will continue to dewater the grit before the grit is expelled into a dumpster below.

- C. All components of the Grit Removal, Washing, and Dewatering System shall be provided by one manufacturer. The entire system shall be manufactured by Eutek Systems, Inc., Hillsboro, Oregon, or approved equal.

1.04 MANUFACTURER'S FIELD SERVICES

The manufacturer of the grit removal system shall provide the services of a factory trained representative for at least 1 man day at the job site. At least 1 man day shall be spent optimizing timers for the grit draw-off to maximize grit removal and operator training so the operators can optimize the timers for seasonal fluctuations.

1.05 SUBMITTALS

- A. Contractor shall submit shop drawings for new grit removal system as follows.
1. Catalog bulletins describing construction. Mark out inapplicable options.
 2. Dimensional sketches of all units.
 3. Weight of each unit mounted on base and weights of all components.
 4. Performance data as specified below.
 5. Motor data as specified in this section.
 6. Alignment, adjustment, and repair instructions.
 7. Manufacturer's installation instructions.
 8. Assembly diagrams.
 9. Guide to troubleshooting.
 10. Lubrication instructions.

1.06 QUALITY ASSURANCE

The Grit Removal, Washing, and Dewatering System manufacturer shall inspect components of the system as required to detect any defects.

The manufacturer of the Grit Removal, Washing and Dewatering System shall have a minimum of five (5) installations within the United States of similar size to the proposed system that are designed with a surface loading of 11.8 gpm/sf or less to achieve the performance requirement of removing a minimum of 95 percent of all grit equal to and larger than 100 micron (specific gravity 2.6) in size.

PART 2 - PRODUCTS

2.01 EQUIPMENT PERFORMANCE

A. General

The grit removal, washing, and dewatering system shall be designed to remove, classify, wash, and dewater grit from screened raw wastewater at a flow of:

1. Peak Wet Weather Flow of 22.5 mgd.

B. Settleable Solids Concentrators

Each headcell settleable solids concentrator unit shall be designed to operate under the following conditions:

1. At Peak Flow 22.0 mgd with a headloss of no more than 12 inches, the unit shall remove minimum 95 percent of all grit equal to and larger than 100 micron (specific gravity 2.6) in size.

C. Grit Separation/Classification Units

1. Each grit separation/classification unit shall be designed at a flow of 0.43 mgd (300 gpm) with a headloss of approximately 15.0 feet.
2. At steady state design flow conditions, each unit shall remove minimum 95 percent of all grit equal to and larger than 50 micron (specific gravity 2.6) in size from design flow rates of 280 to 450 gpm of 0.5 percent TSS headcell settleable solids concentrator unit slurry underflow.

B. Grit Dewatering Escalator Units

1. Each grit dewatering escalator unit shall have a capacity of 2.0 yd³/hr of dewatered grit.
2. Each grit dewatering escalator unit clarifier design shall be based on a settling rate of 3.2 gpm/ft².
3. The dewatered grit from the grit removal, washing, and dewatering system shall, on a weighted average, contain no more than 20 percent (wt) unattached organic solids and a minimum 60 percent solids concentration.
4. The grit dewatering unit shall be characterized by the ability to capture and dewater all grit removed by the grit separation/classification unit. Grit screw classifiers, grasshoppers, reciprocating rakes and similar type of units will not be considered because of their inability to capture and dewater all grit removed by the grit separation/classification unit.

2.02 SETTLEABLE SOLIDS CONCENTRATORS

- A. One (1) settleable solids concentrator units shall be furnished and installed by the Contractor.
- B. Each settleable solids concentrator shall be characterized by a controlled boundary layer flow to enhance settleable solids concentration and removal. Defining characteristics of the boundary layer concentrator units are as follows:
 - 1. Boundary layer flow increasing solids flow toward the center of the units.
 - 2. Self cleaning trays.
 - 3. The ability to settle the grit and organic material to meet the specified conditions.
 - 4. No moving parts within the unit.
 - 5. Single all-hydraulic processes within each unit to achieve grit concentration.
- C. Each settleable solids concentrator unit will have a headloss of 12 inches at the design peak of 22.0 mgd.
- D. Each settleable solids concentrator unit shall consist of a stack of eight (8) nested trays with 904 ft² of settling surface.
- E. Each settleable solids concentrator unit shall be expandable to a stack of twelve (12) nested trays with 1,356 ft² of settling surface.
- F. Each settleable solids concentrator trays shall be nominally 144 inches in diameter and shall be fabricated from corrosion resistant, non-metallic materials.
- G. All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials.
- H. Settleable solids concentrator trays shall be constructed with a minimum ¼ inch material pans and sidewalls.
- I. The stack of trays will securely fit into a 304 SS support frame. The support frame will fit and secure to the bottom of the Contractor supplied concrete support structure containing all necessary hardware and supply piping connections.
 - 1. The concrete tank shall also contain the settled solids underflow connection for removal of settled solids to the grit separation/classification unit as specified.
 - 2. Effluent from the settleable solids concentrator unit shall be weir discharged as shown on the drawings.

- J. Settleable solids concentrator units water requirements
 - 1. Water requirements for operation of the Headcell unit are discussed in Section 2.07 Utility Requirements. A manually actuated bronze ball valve shall be provided to regulate the system water flow rate.

2.03 GRIT SEPARATION / CLASSIFICATION UNITS

One (1) grit separation/classification unit shall be furnished and installed by the Contractor.

- A. The grit separation/classification unit shall be characterized by a dominant, strong free vortex which utilizes centrifugal and gravitational forces and secondary boundary layer velocities to effect the separation, collection and classification of grit from the unit's inflow. Defining characteristics of the dominant free vortex/secondary boundary layer velocity type units are as follows:
 - 1. Dominating increasing tangential velocity profile toward the center of the unit.
 - 2. The ability to handle increasing flows with no loss of the specified grit removal efficiency and with increasing headloss requirements.
 - 3. The ability to classify (wash) the grit from lighter organic material to meet the specified organic solids content.
 - 4. No requirements for electrical or mechanical components flow deflecting/guiding weirs or baffles, or compressed air lines within the unit to meet the specified performance.
 - 5. A single all-hydraulic process within the unit to achieve grit separation, collection, and classification from wastewater.
 - 6. No moving parts within the unit.
 - 7. Continuous removal of washed, clean grit.
- B. Each grit separation/classification unit shall be 32-3/8 inches in diameter and shall be fabricated from 304 stainless steel. Welding shall conform to the most current standards of the American Welding Society. The steel shall conform to materials specifications, as detailed in section 2.08, A. Each grit separation/classification unit shall be fabricated from 1/4 inch thick 304 stainless steel standard dished and flanged heads with 3/16 inch thick stainless steel walls. Exterior surfaces shall be finished in accordance with specifications described in section 2.08, B.
- C. A minimum 18 inch diameter access shall be provided in the top of each grit separation/classification unit. All internal elements shall be removable from inside the unit.
- D. Each grit separation/classification unit shall be mounted to a Grit Dewatering Escalator unit.

- E. The grit underflow from the grit separation/classification units shall be transported by gravity flow to the grit dewatering escalator units.
- F. The grit underflow shall be dewatered by a grit dewatering escalator unit.
- G. Each grit separation/classification unit uses a hydraulic valve to deliver a continuous flow of “washed” grit slurry to the dewatering unit. The hydraulic valve has no mechanical or moving parts.
- H. Grit Separation/Classification unit water requirements:
 - 1. During operation, the grit separation/classification unit requires a continuous source of reclaimed or potable water required to 50 psig \pm 5 psi. The reclaimed or potable water is referred to as system water.
 - 2. Water quantities required for operation are discussed in Section 2.5 Utility Requirements. A manually actuated bronze ball valve shall be provided as a manual shut off.
 - 3. The grit separation/classification unit will have a single 1-1/2 inch NPT pipe stub for connection of the system water.
 - 4. The main supply water valve will be a ball valve provided to allow on/off control of the system water.
 - 5. The piping will branch downstream of the main supply water valve. One branch/supply water line will provide a continuous supply of water to the hydraulic valve. The supply water line will be provided with a globe valve to regulate the flow rate of system water to the hydraulic valve and a solenoid valve to allow automated on/off control. The backwash line will be provided with a solenoid valve to allow automated on/off control of the periodic backwash.
- I. Integrated controls and instrumentation to allow automated operation of the grit separation/classification unit hydraulic valve system are provided by the Manufacturer.
- J. The unit shall be self-standing on three legs to provide a clearance between the bottom of the grit underflow pipe and the dewatering unit clarifier surface. The unit shall have one 6 inch flanged inlet connection and one 8 inch flanged outlet connection. Flanges will be rotatable and conform to ANSI B16.1 bolt patterns.
- K. The unit shall have one (1) 1.5 inch grit underflow connection, one (1) – 3 inch threaded drain connection and one (1) 1.5 inch NPT fluidizing water connection for the hydraulic valve supply and hydraulic valve backwash. All solenoid valves will have brass bodies and NEMA 4 enclosures.

- L. The grit separation/classification unit shall be designed to withstand a maximum working pressure of 14.7 psig. The actual maximum pressure at the inlet will be no more than 14.7 psig.

2.04 GRIT DEWATERING ESCALATORS

- A. One (1) grit dewatering escalator unit shall be furnished and installed by the Contractor.
- B. The grit dewatering units shall be characterized by the ability to capture and dewater all grit removed by the grit separation/classification unit. Grit screw classifiers, grasshoppers, reciprocating rake and similar types of units will not be considered because of their inability to capture and dewater all grit removed by the grit separation/classification unit.
- C. One grit dewatering escalator unit shall have a dewatering capacity of 2.0 yd³/hr.
- D. One grit dewatering escalator unit clarifier design shall be based on a settling rate of 3.2 gpm/ft².
- E. One grit dewatering escalator unit housing shall be 18 inches wide and inclined at 30 degrees.
- F. Belt: One grit dewatering escalator unit belt shall be a 12 inch wide hinged type cleats vulcanized on 12 inch wide 1/8 inch x 1/32 inch two-ply polyester reinforced continuous conductor belting. The belt cleats (3-3/8" X 4-9/16") shall be of molded 60 durometer neoprene construction, aluminum reinforced hinge.
- G. Head and Tailrolls, Retainer Plate, and Scraper
 - 1. Head and tailrolls shall be 304 stainless steel. The 9 3/4 inch lagged headroll shall be designed for adjustable take-up without affecting the headroll retainer plate, scraper, or drive unit adjustments. The tailroll shall be designed to mount internally to the Grit Dewatering Escalator unit belt housing with external sealed bearings.
 - 2. The grit dewatering escalator unit shall be provided with a headroll scraper having 1/4 inch thick high density polyethylene (HDPE) contact surfaces complemented with a 1/4 inch thick HDPE retainer plate. Both retainer plate and scraper shall be loaded to keep belt cleats closed tightly around the headroll during operation.
- H. Self-Cleaning Tailroll Mechanism
 - 1. The belt cleats shall be neoprene and shall open to provide at least a 1-inch

cleat opening when rotated about the tailroll. The grit dewatering escalator unit belt shall be provided with 2 inch openings to allow transfer of fine solids internal to the belt to the underside of each cleat. The tailroll shall be fitted with a scraper, which shall also function as an internal belt scraper.

I. Belt Housing and Clarifier

1. The belt housing shall be fabricated from 0.135-inch thick 304 stainless steel. The steel shall conform to material specifications listed in section 2.6A. Welding shall conform to the most current standard of the American Welding Society. Surfaces shall be finished in accordance with specifications described in Section 2.08, B.
2. The housing shall be provided with clean out plates and (1) flanged 3 inch NP drain in the tailroll end. The Contractor shall connect the provided 3 inch plug valve directly to the 3 inch drain. The plug valve shall be followed by a contractor supplied 3 inch tee with the arm of the tee directed towards an open drain and the straight arm of the tee used as a clean-out.
3. The housing shall be fitted with a clarifier providing at least 17.3 ft² of free water surface and walls sloping at least 45 degrees from the horizontal. The clarifier shall provide at least 3 inches of free board. The clarifier shall be fitted with an overflow weir at least 50 inches long with a 6 inch NP overflow discharge connection.
4. The grit snail 10 gpm belt rinse water will be fed from the slurrycup unit supply water header. The rinse bar system shall be pre-piped and factory installed to provide belt rinse above the water level in the clarifier, clarifier rinse with two spray bars below the clarifier water level, and a rinse bar at the tailroll area. The flow to these rinse bars shall be manually adjustable with a flow indicator at the tailroll rinse. Non-potable water shall be supplied to the rinse system whenever the drive motor is energized. The tailroll rinse will include a 1 inch globe valve to regulate the flow of rinse water to the tailroll section. Two spray bars shall be located above the belt and below the clarifier liquid level to enhance grit washing. This section shall be isolated from the belt rinse water piping with a ¾ inch ball valve for maintenance.
5. A motion detector sensor shall be installed on the side of the grit snail unit and will detect movement of the headroll scraper arm. This will monitor lack of belt movement (possible stalled belt or drive unit failure) and/or scraper arm overload (too much grit counterbalancing the scraper arm).
6. The grit dewatering escalator unit housing shall be inclined at 30 degrees.

J. Support Structure

1. The grit dewatering escalator unit support structure shall be as shown on the general arrangement drawing and anchored to a stable base.

K. Drive Unit

1. The drive unit consisting of the motor and the helical gear reducer shall be mounted as a single integrated unit. Bearings shall be anti-friction, ball or roller type. Heavy-duty bearings are required on the output shaft.
2. The motor shall be 1/3 HP, 3 phase, 230/460 VAC, 60 Hz, NEMA Design B, TENV enclosure, inverter duty motor with a 1.0 service factor. The motor shall have epoxy treated windings.
3. The helical gear reducer will have hardened alloy steel gears accurately cut to shape.
4. A mechanical torque-limiting clutch shall be mounted on the headroll gear assembly to prevent an accidental overload of the drive unit and belt.
5. The drive speed shall be adjusted by a variable speed drive that will be housed in the control enclosure. Belt speed shall be adjustable from 1-5 ft/min.

2.05 CONTROLS AND INSTRUMENTATION

A. One (1) control panel will be furnished and installed. Each control panel shall have a NEMA 4X, 304 stainless steel enclosure, and shall be rated at three phase, 460 VAC. Each panel shall contain all timers, starters, switches, a variable frequency drive, and indicator lights to operate blow-down from one (1) grit removal unit and one (1) dewatering unit in either fully automated or manual mode. Each control panel will be supplied so as to be able to control one (1) slurrycup unit and one (1) grit snail.

B. Control of the grit removal system involves opening/closing valves (to supply reuse plant water) at the slurrycup unit. The grit snail unit that dewateres the grit slurry from the Slurrycup unit will be controlled to provide auto or manual operation, manual starting and stopping, opening and closing of the spray wash water valve on the grit snail unit, and system shut down if the belt does not operate properly.

1. The operating controls shall be furnished by the equipment supplier and shall provide for manual and automatic operation.
2. All control shall be in NEMA type 4X enclosures.
3. The grit dewatering escalator belt shall be ON whenever grit slurry is being transported to it.
4. The controls shall be rated for three-phase, 480 volt, 15-amp power supply.
5. Transformer with 480 volt primary winding and 120 volt secondary winding with fused secondary.
6. Applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact is provided for each relay.
7. Grit snail variable frequency drive with motor overload protection.
8. Terminal strips to receive wires from external devices.

- C. The control panel shall be in a 304 SS NEMA 4X enclosure and shall include the following items:
1. Front panel mounted combination main disconnect switch and circuit breaker
 2. System power indicator
 3. Slurrycup three position HOA switch
 4. Slurrycup supply water three position HOA switch.
 5. Slurrycup supply water valve OPEN indicating light
 6. Slurrycup backwash water valve OPEN indicating light
 7. Slurrycup backwash water valve three position HOA switch
 8. Slurrycup auxiliary backwash pushbutton
 9. System blowdown three position HOA switch
 10. Grit snail running light
 11. Grit snail three position HOA switch
 12. Grit snail fail indicating light
 13. Grit snail reset push button
 14. Grit snail manual STOP push button
 15. Grit snail manual START push button
 16. Grit snail manual speed potentiometer (only with a NEMA 4 enclosure)
 17. Grit snail rinse water valve three position HOA switch
 18. Grit snail rinse water valve OPEN indicating light
 19. Run and fault auxiliary dry contact outputs for customer use.
Each contact shall be Form "C" rated for 3 amps resistive at 24 volts DC.

D. Slurrycup and Grit Snail Operation Summary

1. The slurrycup unit is designed to operate continuously. As the grit slurry is pumped through the slurrycup unit, a small volume of classified (washed) grit slurry continuously underflows from the slurrycup. Control of the grit slurry underflow rate is all-hydraulic, with no mechanical or moving parts. All-hydraulic control of the grit slurry underflow rate requires continuous introduction of a portion of the system water to the hydraulic valve mounted on the bottom of the slurrycup and control of the supply of the system water.
2. Periodically, typically twice an hour during heavy grit loads and typically once every hour during light grit loads, a backwash sequence are initiated to flush the grit underflow gap inside the slurrycup unit. This involves cycling of solenoid valves. Frequency and duration of backwash cycles is operator settable.
3. Periodically, typically once every 4 backwashes, a blowdown sequence is initiated to flush accumulations of debris inside the slurrycup. This involves stopping the flow of grit slurry through the slurrycup, cycling of solenoid valves, and resuming operation. Frequency and duration of blowdown cycles is operator settable. The panel is equipped with a grit pump enable relay that

is normally open. The relay is energized whenever the system is running and de-energized during blowdown.

4. The grit snail clarifier provides sufficient area to settle fixed solids grit onto the continuously running belt with the slurry water overflowing the clarifier weir. The grit snail belt shall run whenever grit slurry is being transported to it.

E. Instrumentation

Pressure gauges furnished, for each unit, shall include:

1. One (1) 0-100 psig pressure gauge to monitor the supply water delivery pressure.
2. One (1) 0-30 psig pressure gauge (P_d) to monitor the pressure in the grit slurry discharge (underflow) line.
3. One (1) 0-30 psig pressure gauge (P_i) to measure the inlet pressure to the Slurrycup.
4. One (1) 0-30 psig pressure gauge (P_m) to monitor wash water delivery pressure.

Flow meters supplied:

1. One 0-35 gpm flow meter for the slurrycup supply water.
2. One 1-10 gpm flow meter for the grit snail tailroll rinse water.
3. One 4-40 gpm flow meter for the headcell fluidizing water.

2.06 CONTROL SEQUENCES

A. Normal Operation

1. There will be one (1) globe valve and one (1) system supply water valve (SSWV) on the slurrycup supply water line (fed from the system water line). The SSWV solenoid valve requires OPEN/CLOSE control. This valve is open any time the system is operating, allowing the flow of clarified water to the slurrycup. The globe valve will be adjusted to achieve optimum flow to the hydraulic valve, as read on the flow meter.

B. Backwash Sequence

1. There will be one (1) backwash solenoid valve on the slurrycup backwash line (fed from the System Water line). The valve requires OPEN/CLOSE control for this normally closed valve. During normal operation, this solenoid valve will be opened for 1-2 minutes when inflow is first introduced into the slurrycup and for 1-2 minutes at site-specific intervals while the system is in backwash operation. The backwash frequency and duration is operator adjustable. The valve also opens during a blowdown sequence.

C. Blowdown Sequence

1. An accumulation of debris in the bottom of the slurrycup should be removed periodically depending on screen opening size and plant flow conditions. A blowdown sequence requires opening of BWV, and de-energizing the grit pump enable relay to stop the grit slurry feed to the slurrycup for a field adjustable time of typically 2-5 minutes. Stopping the grit underflow feed can be accomplished by either shutting down the grit slurry feed pump(s) or closing the inlet valve in a piping system with a header. After this time, grit flow is re-established and BWV is opened for a short time (typically 1-2 minutes). A blowdown sequence will occur after a field adjustable time of typically 2-8 hours. A blowdown sequence also occurs at system shut down.

D. System Shutdown Sequence

1. When the system is to be shut down, a blowdown sequence shall be initiated but the grit slurry feed to the slurrycup will not be restarted. The grit snail belt shall run for a minimum amount of time after a system shut down occurs to allow the belt to dewater all the grit that was dumped. The time set will be adjustable from 0-60 minutes and normally be set at 15 minutes.

E. Grit Snail Controls

1. The operating controls shall be furnished and shall provide for manual and automatic operation. The controls shall include a variable frequency drive (VFD) to drive the motor. All controls shall be located in NEMA type 4X enclosures. The belt shall run whenever grit slurry is being transported to it.
2. The belt speed will be adjusted by a manual speed control potentiometer on the NEMA 4X control panel.
3. A motion sensor is installed on the side of the grit snail take-up frame. The motion sensor will protect the system against possible belt stall, drive unit failure, and/or scraper arm overload. The motion detector sensor will detect the cycle of the scraper arm and output a contact closure to a timer. During normal operation, the sensor sends a signal each time one of the cleats on the belt passes the scraper arm. The timer will normally be set for the maximum amount of time it takes two cleats to close the motion detector switch. This will vary with the speed of the belt. If there is lack of belt movement or if there is a scraper arm overload, there will be no signal from the motion sensor. If the motion sensor fails to reset the timer, the grit snail stops and the failure light illuminates.

2.07 UTILITY REQUIREMENTS

A. Water

1. A potable or reuse water source providing minimum 20 gpm, 50 psig for each headcell settleable solids concentrator unit, at the system water connection via a 1 inch NPT line shall be provided to meet system water needs. A manually actuated bronze ball valve shall be provided to regulate the system water flow rate.
2. Each slurrycup/grit snail combination will require clarified non-potable or city water supply at a regulated 50 psig \pm 5 psi shall also be provided in a single 1-1/2-inch diameter NPT line. The water requirements are as follows:
3. A continuous supply of 40 gpm is required, 30 gpm for normal operation of each slurrycup unit and 10 gpm for normal operation of each grit snail unit.
4. An additional 47 gpm is a short duration, intermittent requirement for the periodic backwash cycle of the slurry cup unit. Actual frequency and duration of use varies with grit load. Typical maximum usage is 1-2 minutes of duration every 60 minutes.

B. Power

1. The contractor shall supply one circuit for each control panel and shall be rated for three phase 480 volt, 15 amp supply.

2.08 MATERIALS AND FINISHES

A. Materials

304 Stainless Steel

Plate and Sheet	ASTM A 167 ASTM A 240
Bar	ASTM A 276 ASTM A 479
Tube	ASTM A 312 ASTM A 544

B. Exterior Surfaces Finishes

1. Surface Finishing: acid washed and glass bead blasted to a uniform finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation of the grit removal system shall be performed by the Contractor in accordance with instructions provided by the Manufacturer.

3.02 START-UP, TRAINING, AND MANUFACTURER'S SERVICES

- A. The Manufacturer shall provide one (1) man, maximum two (2) trips, start-up and instruction services as required for maximum total of four (4) days.

END OF SECTION

SECTION 11314

RECESSED IMPELLER PUMPS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall finish and install one (1) grit pump at the new influent structure. The pump shall move grit from the headcell unit to the grit slurry unit above as shown on the drawings.

1.02 RELATED WORK

- A. Section 09900 - Heavy Duty Finishes
- B. Division 16 - Electrical

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit dimensional drawings.
- C. Submit manufacturer's catalog data. Show materials of construction by ASTM reference and grade.
- D. Submit pump curves from manufacturer's catalog data on which the specified operating points are marked. Show efficiency and brake horsepower for the selected pump curve. Show NPSH required.
- E. Submit manufacturer's reports on hydrostatic tests and performance tests.
- F. Submit manufacturer's sample form for reporting the performance test results at least two weeks before the tests.
- G. Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory. Show pump total head, torque, brake horsepower, pump efficiency, and required NPSH. Provide copies of the data recorded during the test and methods of data reduction for determining certified test results.
- H. Submit manufacturer's drawings and calculations for intermediate shafting for vertically driven pumps. Show shaft lengths, locations of intermediate bearing supports, and shaft critical speed.
- I. Submit motor data.

1.04 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

- A. One labor day for each service listed in the subsection on "Service Conditions" to check the installation and advise during start-up, testing, and adjustment of the pumps.
- B. One labor day to instruct the Owner's personnel in the operation and maintenance of the pumps.

PART 2 - MATERIALS

2.01 PUMP DESIGN

- A. Equipment for the pumps, including motors, baseplates, shall be provided as a complete unit by the pump manufacturer.
- B. The design pressure of the casing, including the stuffing box and gland, shall be at least 60 psig. Design casing to withstand a hydrostatic test pressure of 150% of the maximum design pressure for the pump or 125% of the shutoff head, whichever is greater.
- C. Each pump shall be capable of at least a 10% head increase at normal operating conditions by installing a larger impeller or an impeller of different hydraulic design.
- D. Pump curve shall be continuously rising and shall be free of dips and valleys from the design point to the shutoff head. The shutoff head shall be at least 110% of the head that occurs at the design point.
- E. The NPSH required shall be at least 5 feet less than the minimum NPSH available at all points on the pump curve up to 120% of the flow at the BEP.
Design the pumps and its components to operate continuously over a flow range of 60% to 120% of the flow at the BEP.

2.02 SUCTION AND DISCHARGE CONNECTIONS

Suction and Discharge Connections shall be flanged, ASME B16.1, Class 125. Flanges shall be capable of connecting to flat-faced flanges and provide watertight connection. Bolt holes shall straddle the horizontal and vertical centerlines.

2.03 CASING

- A. Pump casing shall be completely open from suction to discharge. Provide internal case clearances equal to the discharge size. Provide rounded internal passages within the casing; do not use square passages.
- B. Minimum casing thickness shall be:

Suction Size (inches)	Casing Thickness (inches)
3	1/2
4-6	3/4
8 and larger	1

- C. Provide threaded drain connections (minimum 1/2-inch size) in the gland housing. Alternatively, provide a self-draining design with a large (minimum 1-inch) opening.

2.04 IMPELLERS

- A. Provide completely recessed impellers mounted completely out of the flow path between the pump inlet and outlet so that solids are not required to pass through the impeller. Impeller tip speed shall not exceed 4,500 fpm.
- B. Provide a removable wear plate behind the impeller. Design the wear plate to direct flow from behind the impeller.

2.05 SUCTION PIECES

- A. Provide 90-degree suction elbow with cleanout for vertical pumps. Provide 1/8-inch-thick gasket between elbow and pump inlet. Capscrews or bolts connecting the suction elbow to the casing shall be Type 316 stainless steel, ASTM A276.
- B. Provide a suction piece integrally cast with the casing and having the same thickness as the casing. Design shall allow removal of the impeller from the rear of the casing.
- C. Grit pump shall be as manufactured by Hayward Gordon XR Series, Wemco Model C or equal.

2.06 PUMP SHAFT

- A. Tolerance on the shaft diameter through the stuffing box shall not exceed 0.002 inch. Shaft runout on the stuffing box face and at the impeller shall not exceed 0.002-inch full indication movement. Dynamic shaft deflection at the stuffing box face shall not exceed 0.002 inch.

- B. The first lateral critical speed of the rotating assembly shall be at least 120% of the maximum pump operating speed.
- C. Shaft material shall be constructed of 4140 steel. Provide stainless steel shaft sleeve extending completely through the gland. Shaft sleeve material shall be AISI Type 316 stainless steel, ASTM A743.

2.07 BEARINGS

- A. Provide two antifriction bearing assemblies for flexible coupled pumps and one bearing assembly for close-coupled pumps. One assembly shall be free to float within the frame to carry radial thrust only. Design the other assembly to carry both radial and axial thrust. Bearings subject to radial thrust only shall be single or double row. Bearings subject to both radial and axial thrust shall be double or triple row. Minimum bearing life per the AFBMA L-10 rating shall be 100,000 hours.
- B. Bearings shall be either grease or oil lubricated. Bearing housings shall have register fits and shall be bolted to pump casing. Provide ZERK lubrication fittings when grease lubrication is used. Provide constant level oiler when oil lubrication is used.

2.08 MATERIALS OF CONSTRUCTION

- A. Material of construction for the various pump duties shall be as listed below:

Component	Material
Casing	Super Ni-Hard ASTM 532
Impeller	Super Ni-Hard ASTM 532
Case wear ring or plate	Super Ni-Hard ASTM 532
Casing capscrews	Stainless Steel
Gland eyebolts and nuts	Stainless Steel

2.09 COUPLINGS AND COUPLING GUARDS FOR FLEXIBLE COUPLED PUMPS

Provide flexible couplings between the motor and pump shafts. Couplings shall be of the spacer type with flexible disk elements. Coupling hubs shall be steel. Disks shall be EPDM or Hytrel. The spacer shall permit the removal of the coupling, bearings, seal, and rotor without disturbing the driver or the suction and discharge piping. Couplings shall be keyed in place. A service factor of at least 1.25 shall be used in selecting couplings, based on the manufacturer's ratings. Provide coupling guards conforming to OSHA requirements.

2.10 BASEPLATES

- A. Mount entire pump and motor system on a single common Baseplate of structural steel channel or fabricated steel, ASTM A36.

2.11 FACTORY HYDROSTATIC TESTING

Hydrostatically test casings and covers for 10 minutes minimum with water at shutoff pressure.

2.12 SPARE PARTS

Provide the following spare parts for each model or size pump:

Quantity	Description
1	Mechanical seal
1	Impeller wear ring or plate
2	Sets radial bearings
2	Sets thrust bearings

2.13 PRESSURE INSTRUMENTS

- A. Type:
1. Diaphragm actuated.
- B. Functional / Performance
1. Repeatability – Better than 1.0 percent of pressure.
 2. Set Point – Field adjustable and set between 30 and 70 percent of the adjustable range.
 3. Deadband – Shall be fixed unless noted otherwise.
 4. Reset – Unit shall be of the automatic reset type unless noted otherwise.
 5. Overrange Protection – Provide overrange protection to maximize process line pressure.
 6. Switch Rating – 250V AC at 10 amps; and 30V DC at 5 amps.
- C. Physical:
1. Housing – Nema 4X.
 2. Switching arrangement – Provide single pole double throw (SPDT).
 3. Wetted Parts – Teflon coated diaphragm, viton seals, stainless steel connection port.
 4. Connection Size – ¼-inch NPT.
- D. Accessories / Options Required:
1. Shut-off Valve – Provide a stainless steel process shut-off valve which can be used as an adjustable pressure snubber.

- E. Manufacturer:
 - 1. Staic-O-Ring (SOR)
 - 2. United Electric
 - 3. Ashcroft
 - 4. or Approved Equal

- F. Pressure Gauge
 - 1. Type:
 - a. Bourdon tube actuated pressure gage.

 - 2. Functional Performance:
 - a. Accuracy – Plus or minus 1.0 percent of span or better.

 - 3. Physical:
 - a. Case – Phenolic shock resistant or 316 stainless steel for surface / tem mounting with a pressure relieving back. The case shall be vented for temperature / atmospheric compensation. Gage shall be capable of being liquid filled in the field or at the factory.

 - 4. Accessories / Options Required:
 - a. Shut-off Valve – Provide a stainless steel process shut-off valve which can be used as an adjustable pressure snubber.
 - b. Gauges shall be liquid filled at the factory.

 - 5. Manufacturer:
 - b. McDaniel Controls
 - c. Ametek – U.S. Gauge Division
 - d. Ashcroft
 - e. or Approved Equal

PART 3 - EXECUTION

3.01 PUMP INSTALLATION

- A. Provide the manufacturer's recommended lubricants in the pumps, bearings and other mechanical equipment.
- B. Prepare foundation, mount driver, level the base, align pumps, and install couplings.

3.02 PERFORMANCE TESTING

- A. Each pumping unit shall be subjected to factory performance test. Conduct tests in accordance with the Hydraulic Institute Standards. Take a minimum of six points from shutoff head to 120% of maximum design flow to plot the pump curve. Take

points at approximately equal intervals between shutoff head and 120% of maximum design flow.

- B. No motor overload above motor nameplate horsepower rating will be allowed at any flow up to 120% of the flow at the BEP.

3.03 PAINTING AND COATING

- A. Coat exposed surfaces of pump and motor the same as the adjacent piping. If the adjacent piping is not coated, then coat per Section 09900. Apply the specified prime finish coats at the place of manufacture. Apply finish coats in field.

3.04 SERVICE CONDITIONS

- A. Pump hydraulic performance conditions and design data shall be as shown below.
- B. Pump Tag Numbers:

Liquid Pumped	Grit
Capacity (gpm)	Pump Total Head (feet)
100	21.0
250	19.7
350	18.2
Maximum Pump Speed:	1750 rpm
Minimum NPSH Available:	18 feet
Motor Horsepower:	5
Variable Speed Drive Required:	Yes
Type of Seals:	Double Seal, Hard Faces

3.05 FIELD TESTING

- A. Bump motor to ensure that motor has been connected for proper rotation.
- B. If the measured flows at the above-tabulated pump heads are more than 5% below the flows obtained on the factory test, adjust the impellers or provide new impellers or otherwise repair or replace the pumps or calibrate meters or pressure gauges.
- C. Operate each pump one at a time. Manually adjust the speed for each pump (one at a time) via the respective speed control unit such that the pump output is 30%, 40%, 50%, 60%, 80%, and 100% of the maximum capacity specified. The duration at each flow rate shall be at least one hour.

- D. Assure that each solenoid valve on the seal water supply line opens and closes when its respective pump starts and stops. Start and stop each pump twice and verify that the pump/solenoid interlock functions.
- E. Demonstrate that the pumping units, motors, and control system meet the following requirements:
 - 1. The pumping units operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.
 - 2. All automatic and manual controls function in accordance with the specified requirements.
 - 3. All drive equipment operates without being overloaded.

END OF SECTION

SECTION 11315

SELF-CLEANING INFLUENT FILTER/SCREEN

PART 1 - GENERAL

1.01 REQUIREMENTS

- A. The Contractor shall furnish and install one (1) new fully automatic screening unit complete and operable, in accordance with the Contract Documents. The equipment shall be of the latest design and shall be fabricated of materials and in a fashion that will fully perform the functions described below.
- B. The Contractor shall have the responsibility to coordinate the installation of the equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01600 - Materials and Equipment
- B. Section 05500 - Miscellaneous Metals
- C. Section 09900 - Heavy Duty Finishes
- D. Division 16 - Electrical

1.03 SUBMITTALS

- A. Product Data - In accordance with Section 01340 – Shop Drawings, Project Data and Samples, submit manufacturer's technical product data, including installation instructions for the unit. Include range, ratings, detailed drawings and electrical diagrams, certified by the manufacturer.

1.04 MANUFACTURER'S SERVICE

- A. The Contractor shall obtain the services of a qualified factory representative following installation for startup inspection and training of the plant operations staff. The factory representative shall be on-site for at least two full days.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications - Firms regularly engaged in the manufacture of screening equipment and wastewater treatment plant equipment of the type and size

required. Manufacturers must have been engaged in the manufacture of similar systems for a minimum of five (5) years and have similar units in satisfactory service. The Manufacturer must supply all equipment.

PART 2 - PRODUCTS

2.01 EXPERIENCE

- A. The Contractor shall provide only products that have a proven reliability record of at least five (5) years in operation. NO equipment shall be considered which has an operating history of less than five (5) years.

2.02 SCREENING

- A. The automatic self-cleaning filter screen shall be suitable for installation and operation in a channel measuring 4.0 ft. wide and 5.0 ft. deep, as measured from the nominal elevation of the channel bottom one channel width behind its base. The angle of inclination shall be 75 degrees from horizontal. There shall be a 0.50 inch recess (notch) in the channel bottom to accommodate the base of the screen.
- B. The opening from which the unit discharges screenings from its enclosure shall be at least 5.5 ft. above the elevation at which its support legs are mounted. This is the available clearance for the compactor to collect the debris.
- C. The total discharge height of the screen, as measured from its base to the screenings discharge point, shall be 10.5 ft.
- D. The screen shall be capable of passing a maximum of 15.0 MGD of wastewater with a downstream water level of 2.25 ft. based on a nominal unit width of 4 ft. The loss of head at the maximum flow of clean water shall not exceed 21 inches of water. The head loss calculation is based on assumption of a clean screen, clean water and steady state flow.
- E. The screen shall be capable of presenting a clean filtration surface to the influent stream at all times during continuous operation. It shall be capable of intermittent operation in order to form a mat of material to provide maximum trash removal. Additionally, in order to maximize the capture of paper, rags, and other flexible debris, which tends to drape over and adhere to the filtration surfaces, the screen shall have 0.694 square feet of contact surface area per square foot of wetted filtration belt frontal surface.
- F. The unit shall be capable of handling 4.128 cubic yards per hour of trash in order to ensure that the maximum amount captured by the screen can be transported out of the

channel and into the waiting receptacle.

2.03 EQUIPMENT

A. Screening

1. The frame of the unit, which is stationary, shall be constructed from 316 stainless steel with a thickness of 1/2 inch. It supports and locates all of the operating components. The unit shall rest at the bottom of the channel, and be anchored at the operating floor elevation. No mounting or fastening of the unit frame shall be required to the sidewalls or bottom of the channel.
2. The "A" frame unit shall be supported at the operating floor elevation by support legs constructed from 316 stainless steel. The legs shall be designed to allow the unit to pivot the screen out of the channel without dewatering (e.g. for bypass purposes). Routine service of the unit is possible with the screen in the channel.
3. Guide rails shall be mounted to each side on the inside surface of the frame to direct the filter belt during its ascension out of the channel. The guide rails shall be 1 inch thick and will be constructed from 316 stainless steel.
4. At the top of the screen, circular chain guides shall gently direct the filter belt from its ascending path out of the channel towards the drive sprockets. These circular guides shall be constructed from 316 stainless steel and shall be welded to a 316 stainless steel shaft. In order to reduce the wear on both the chain and chain guides, the shaft shall be secured to bearings on each side of the frame and free to rotate.
5. Circular chain guides shall also be provided to direct the filter belt from the drive sprockets to the descending path into the channel. These circular guides shall be constructed from 3/4-inch thick 316 stainless steel and shall be welded to a 316 stainless steel shaft. In order to reduce the wear on both the chain and chain guides, the shaft shall be secured to bearings on each side of the frame and free to rotate.
6. Lower return guides shall be provided at the base of the screen to direct the filter belt during its 180-degree turn from the descending to ascending paths. The lower guide rails shall be constructed from 316 stainless steel and shall be fixed in place as low as possible in the frame to optimize the submerged screen area. No submerged bearing or rotating guides are used that will require routine maintenance or that may become fouled by trash and debris.
7. Neoprene rubber seals with 316 stainless steel backing plates shall be mounted along the upstream edges of the frame to seal the outer edge of the

frame against the channel wall, and the area between the frame and filter belt side plates.

8. The bottom of the unit shall be sealed with two rows of nylon brushes, which allow the elements to pass through, but prevents trash from passing beneath the filter elements, ensuring capture of all solids and trash by the filter belt.
9. All shaft bearings are mounted externally to the side frame for ease of access and maintenance.
10. The portion of the screen above the channel shall be equipped with covers to help control the emission of odors and protect operators from contact with moving parts. The covers will also minimize misting and dripping. All enclosures shall be removable. There shall be hinged sections on the front and rear of the unit for access to the screen and rotating brush assembly for periodic maintenance. The covers shall be fabricated from 14 gage 316 stainless steel.

B. Filter Belt/Screen Assembly

1. The screen shall provide dual filtration of all materials in order to minimize compaction of captured debris and minimize the head loss through the screen. This shall be accomplished by recessing the horizontal fine filtration opening in the face of the screen. The coarse horizontal openings formed by the upper or forward shank/arm of the elements shall be 14 mm and shall be the first opening the flow stream contacts as it passes through the screen. The lower or recessed shank/arm of the elements shall create a two dimensional grid which limits the maximum vertical opening to 59 mm and the fine horizontal opening of 6 mm. The elements are arranged in a staggered fashion to form an endless belt and to create a range of motion that allows the recessed shank/arm of one row of elements to pass through the plane of the forward arm of the next row of elements it meshes with. Each filter element shall be a single molded component with a rake integral to its shape. The filter belt shall form a row of these rakes spaced every 8 inches, capable of lifting material of up to 7 inches in diameter out of the channel. The elements are secured to two separate filter shafts that pass through individual bosses in the elements.
2. The side plates (or end plates) are mounted next to the outermost elements of each filter row, and overlap to form a continuous moving sidewall for the filter belt. This moving wall prevents captured trash and debris from spilling over the sides of the filter belt. The side plates shall be constructed from a high strength phenolic resin.

3. The tension of the moving screen/filter belt assembly shall be completely supported by a stainless steel link chain. The chain must connect the filter shaft ends on both sides of the belt assembly so that the elements are free of tension, and support no weight of the assembly. The chain shall be of closed link design with 2 link sidebars, chain rollers and pins per link. The chain assembly shall have a minimum cross sectional area of 0.203 square inches at the weakest point of any individual link sidebar.
4. Chains shall be supplied with hollow pins that allow for the removal and replacement of the filter shafts, side plates and filter elements without releasing the chain tension. The unit is designed to allow this function to take place at the operating floor elevation with the screen in the channel. Chain rollers shall have a diameter of 3 inches.
5. All chain components shall be corrosion resistant stainless steel. Sidebars shall be 316 stainless steel. Pins and rollers shall be 410 stainless steel and the bushings shall be 416 stainless steel. 400 series components shall be heat treated to a minimum hardness of 39 on the Rockwell C Scale.
6. The filter shafts shall have a diameter of 1-3/8 inch and be spaced on 8-inch centers in the direction of travel of the filter belt. The shafts shall be constructed from 316 stainless steel.

C. Drive Assembly

1. The drive assembly consists of a gear reducer, motor, drive, sprocket, driven sprocket, drive chain, drive chain idler, drive shaft, and take up bearings. The drive mechanism shall be protected from the trash stream to ensure that the screen runs smoothly without jamming. The driving force must be transmitted to clean, trash free components to avoid mis-tracking or binding, which could render the screen inoperable, requiring manual cleaning and realignment.
2. The gear reducer is to be of cycloid gear design by Sumimoto or equal, mounted directly on to the unit at the top of the frame and connected to the drive shaft with a with the drive chain, drive and driven sprockets. The reducer shall be designed in accordance with AGMA recommendations for Class II service based on the required horsepower for operation of the machine.
3. The motor shall be a squirrel cage induction motor, TEFC, 230/460 volt, 3-phase, 60 Hz, 1800 RPM by Reliance. The motor Horsepower shall be 1/2 Hp. Motor shall be acceptable for use in a Class 1 Division 2 environment in accordance with paragraph 501-8(b) of the National Electrical Code.

4. Overload protection shall be provided by an electrical overload device that senses motor current draw.
5. The filter belt drive shaft is located in the head of the unit and is supported at each end by the take up bearings. The filter belt sprockets that engage the filter bed chain rollers and transmit motion to the filter belt assembly are welded to the drive shaft. The drive shaft and sprockets shall be constructed from 316 stainless steel.

D. Rotating Brush Assembly

1. The filter belt assembly is cleaned by the interaction of the filter elements and the rotating brush assembly without requiring any water or other mechanical devices capable of jamming (i.e. doctor blade) to remove the captured material.
2. The rotating brush assembly is supported by bearings on each side of the machine mounted externally to the machine frame. The brush is chain driven by the filter belt drive shaft.
3. The brush is comprised of three separate components, the brush shaft, the brush and the brush hubs. The shaft is made of 316 stainless steel. The brush is composed of nylon bristles and secured to the shaft at each end by the brush hubs. The brush hubs are made of 316 stainless steel.
4. The brush shall be orientated in a paddlewheel design with rows of bristles located at 90, 180, 270, and 360 degrees.

E. Discharge Chute

1. A discharge chute shall be provided integral to the machine, constructed from 14 gage 316 stainless steel and designed to direct the screenings to the collection equipment below.
2. The chute shall have a 1/4-inch thick flange that shall allow it to be connected to and collection equipment.

F. Lubrication

1. Lubrication lines shall be extended from each bearing housing to a central point located on the respective side of the machine, accessible from the operating floor for ease of maintenance.

2.06 FASTENERS

- A. All fasteners will be type 316 stainless steel.

2.07 SURFACE FINISH

- A. Surface Treatment of Stainless Steel Components. All frame and structural members will be mechanically cleaned using Dupont Starblast. Sheet metal components such as covers or the discharge chute will be furnished with a 2B finish.
- B. Motors, gear reducers, bearings, sprockets and solenoid valves will be manufacturer's standard finish.

2.08 ELECTRICAL DEVICES AND CONTROLS

- A. Electrical Devices: Interconnecting conduit and wiring will be the responsibility of the installing contractor. In addition to the drive motors, the following electrical devices will be furnished with each system:
 - 1. Explosion Proof Ultrasonic Differential Level Sensors. A Milltronics HydroRanger 200 ultrasonic level controller will be supplied with two (2) ST-H transducers, FM rated for Class 1, Division 1, Groups C and D. Each sensor is supplied with 33 feet of integral cable with a 1-inch NPT conduit connection. A 316 stainless steel mounting bracket will be provided for each sensor.
 - 2. Emergency Stop Local Push Button Station. A NEMA 4X polycarbonate emergency stop push button station will be mounted to the frame of the unit with a 1/2" NPT conduit connection.
 - 3. Two (2) 2-Way Solenoid Valves.. The 120 volt, single phase, 60 Hz normally closed solenoid valve, housed in a NEMA 4X enclosure will have 18-inch-long integral leads and will have a 3/4 inch NPT conduit connection. (rotopress and spiralklean water lines)
 - 4. One (1) 4-Way Solenoid Valves. The 120 volt, single phase, 60 Hz solenoid valve, housed in a NEMA 4X enclosure will have 18-inch-long integral leads and will have a 1/2 inch NPT conduit connection. (spiralklean knife gate air line)
- B. Controls: The following controls will be provided: A 480 Volt primary U.L. listed and labeled control panel in a NEMA 4X enclosure. It will contain the following logic devices for proper operation of the equipment.
 - 1. Relays and timers to perform necessary logic functions and monitor equipment mounted electrical devices.
 - 2. Emergency Stop push button.
 - 3. Hand-Off-Auto selector switch for screen operation.
 - 4. Control power and run indicating lights.

5. Motor current monitor and hour meter.
 6. Fault indicating light and system reset pushbutton.
 7. Run and fault auxiliary dry contact outputs for customer use. Each output shall be form "C" rated for minimum 3 amps resistive at 24 volts DC.
- C. A step-down control transformer, motor starters and main disconnect will be provided.
- D. Sequence of Operation
1. Hand Operation.
 - a. Screen. When the Hand mode is selected, the screen will run via the Forward-Off-Reverse selector switch. Placing the selector switch in the OFF position will stop the screen.
 2. Automatic Operation
 - a. Screen. When the Auto mode is selected, the unit will run via the water level sensor or repeat cycle timer. After the water level has lowered, the unit will continue to run for the length of time set on the off delay timer, typically set at 30 seconds.
 3. Emergency Stop. The units can be deactivated at any time by pressing either the control panel or unit mounted Emergency Stop push buttons.
 4. Fault Conditions. Motor overload or high motor current will stop the drive motors and illuminate the fault light.

2.09 ANCHOR BOLTS

- A. The manufacturer will supply 316 stainless steel threaded rods for use with the HILTI HY-150 Adhesive Anchoring system. Adhesive to be provided by others.

2.10 FACTORY SERVICE

- A. The manufacturer will provide a qualified service representative following installation for one (1) trip for two (2) days for inspection of installation, equipment startup and operator training.

2.11 FACTORY ASSEMBLY, TESTING, AND INSPECTION

- A. The equipment shall be factory assembled and tested prior to being shipped. The Engineer and/or Owner may, at their option and own expense, witness the factory test. The equipment will be shipped completely assembled other than the motor/reducer, discharge chute and support legs. It shall be capable of being set in place and field erected by the contractor with a minimum of field assembly.

2.12 INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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

2.13 SPARE PARTS

The following spare parts shall be provided for each automatic self-cleaning filter screen.

- A. 20 - Filter Elements
- B. 10 - Side Plates
- C. 20 - Snap Rings, 3/4" Dia.
- D. 10 - Snap Rings, 63/64" Dia.
- E. 1 - Rotating Brush Core Placement Assembly.

2.14 MANUFACTURER

The automatic self-cleaning filter screen shall be model AG-S-A 75 degree 4'x10.5', 6 mm/SK100/RP200 BioGuard Influent Cleaning Systems as manufactured by Parkson Corporation, Ft. Lauderdale, Florida or approved equivalent.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation shall be in strict accordance with contract documents and requirements of the manufacturer's written instructions and shop drawings. It is the Contractor's responsibility to verify the accuracy of all necessary dimensions in the field to ensure compatibility with the specifications and equipment.
- B. In the event that equipment is supplied which is different than specified, it shall be the responsibility of the Contractor to coordinate and make all changes to related structures, controls, drawings and documentation. All changes must be reviewed and approved by the engineer prior to any installation of equipment. In addition, all costs associated with such changes shall be borne by the Contractor.

3.02 EQUIPMENT TESTING

- A. Upon completion of installation by the Contractor and startup of the equipment by the Manufacturer's field service representative, the equipment shall be operated under the supervision of the Contractor for a minimum of eight (8) hours. The purpose is to

ensure that all clearances, vibrations, tracking and motor operating characteristics are within acceptable limits.

END OF SECTION

SECTION 11316

VERTICAL CENTRIFUGAL PUMP

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall finish and install two (2) Thermoplastic Sump-Gard SG Vertical Centrifugal pumps, or equal, at the new influent structure. The pumps shall move drain water from the wetwell to the influent channel of the headworks as shown on the drawings.

1.02 RELATED WORK

- A. Section 09900 - Heavy Duty Finishes
- B. Division 16 - Electrical

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions.
- B. Submit dimensional drawings.
- C. Submit manufacturer's catalog data. Show materials of construction by ASTM reference and grade.
- D. Submit pump curves from manufacturer's catalog data on which the specified operating points are marked. Show efficiency and brake horsepower for the selected pump curve. Show NPSH required.
- E. Submit manufacturer's reports on hydrostatic tests and performance tests.
- F. Submit manufacturer's sample form for reporting the performance test results at least two weeks before the tests.
- G. Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory. Show pump total head, torque, brake horsepower, pump efficiency, and required NPSH. Provide copies of the data recorded during the test and methods of data reduction for determining certified test results.
- H. Submit manufacturer's drawings and calculations for intermediate shafting for vertically driven pumps. Show shaft lengths, locations of intermediate bearing supports, and shaft critical speed.

- I. Submit motor data.

1.04 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

- A. One labor day for to check the installation and advise during start-up, testing, and adjustment of the pumps, and training of the Owner's personnel.

PART 2 - MATERIALS

2.01 PUMP DESIGN

- A. Equipment for the pumps, including motors, baseplates, shall be provided as a complete unit by the pump manufacturer.
- B. Thermoplastic vertical centrifugal pumps shall be Sump-Gard SG-800 as manufactured by Vanton or equal.

2.02 SUCTION AND DISCHARGE CONNECTIONS

- A. Suction and Discharge Connections shall be flanged, ASME B16.1, Class 125. Flanges shall be capable of connecting to flat-faced flanges and provide watertight connection. Bolt holes shall straddle the horizontal and vertical centerlines.

2.03 CASING AND CASING COVER

- A. Pump casing and casing cover shall be constructed of injection molded homogeneous thermoplastic material selected for compatibility with the fluids being pumped.

2.04 IMPELLERS

- A. Impellers shall be constructed of thermoplastic material injection molded with an embedded dynamically balanced stainless steel insert with radial vanes.
- B. Impellers shall be of closed or semiopen vane design and have a keyway for mounting on the shaft to assure positive drive.

2.05 SUCTION PIECES

- A. A strainer basket shall be provided in the same material as the pump casing and cover.

2.06 PUMP SHAFT

- A. The pump shaft material shall be constructed of stainless steel sleeved with thermoplastic material to isolate it from the fluid, and machined at the drive end to fit a flexible coupling.
- B. The immersed portion of the shaft is to be guided by sleeve bearings consisting of ultra pure alumina ceramic inner sleeve and Vanite (siliconized graphite) outer sleeve.
- C. Bearings shall be lubricated by pumped fluid, or flushed and lubricated by external water.

2.07 THERMAL FLUCTUATION MODIFICATION (TFM)

- A. Casing, impeller and suction nozzle shall be designed to accommodate temperature fluctuation without change in pump performance.

2.08 VERTICAL SUPPORT COLUMN AND DISCHARGE PIPE

- A. The support column and discharge pipe shall be fabricated of heavy-sectioned thermoplastic. The upper portion of the column to be fitted with a nonmetallic vapor seal to protect motor and ball bearings in mounting brackets.

2.09 COVER PLATE

- A. The cover plate shall be sized and shaped to fit the sump, and furnished in the same or compatible thermoplastic material as the pump. All of the hardware below the coverplate shall be nonmetallic.

2.10 MOTOR MOUNTING BRACKET

- A. The motor mounting bracket shall have precision-machined mounting surfaces for a rabbet fit to automatically align pump and motor coupling.
- B. The assembly shall be designed to house regreasable ball bearing(s) for positioning and locking the shaft into position and to allow adjustable impeller clearance without removing the pump for installation.
- C. The cast iron motor mounting bracket shall be painted with a two-part chemical resistant epoxy resin or similar resistant coating material.

2.11 FACTORY TESTING

- A. Each pump shall be tested to assure performance at conditions of service. Test data to be permanently recorded and retrievable on request.

2.12 MOTOR

- A. The motor will be vertical mounted horizontal footless corrosive duty 3 phase 60 hertz 460 motor with TEFC type enclosure with drains and breathers. The conduit box will be NEMA 4 type enclosure. Motor will be supplied by the pump manufacture.

2.13 COUPLING

- A. The coupling will be used to couple the pump and the motor. The coupling will be crown type split sleeve with key and lock screwed to pump and motor shaft. The couplings will be steel manufacture and the sleeve will be rubber. The coupling will be designed for 1.20 service factor.

PART 3 - EXECUTION

3.01 PUMP INSTALLATION

- A. Provide the manufacturer's recommended lubricants in the pumps, bearings and other mechanical equipment.
- B. Prepare foundation, mount driver, level the base, align pumps, and install couplings.

3.02 PERFORMANCE TESTING

- A. Each pumping unit shall be subjected to factory performance test. Conduct tests in accordance with the Hydraulic Institute Standards. Take a minimum of six points from shutoff head to 120% of maximum design flow to plot the pump curve. Take points at approximately equal intervals between shutoff head and 120% of maximum design flow.
- B. No motor overload above motor nameplate horsepower rating will be allowed at any flow up to 120% of the flow at the BEP.

3.03 PAINTING AND COATING

- A. Coat exposed surfaces of pump and motor the same as the adjacent piping. If the adjacent piping is not coated, then coat per Section 09900. Apply the specified prime finish coats at the place of manufacture. Apply finish coats in field.

3.04 SERVICE CONDITIONS

- A. Pump hydraulic performance conditions and design data shall be as shown below.

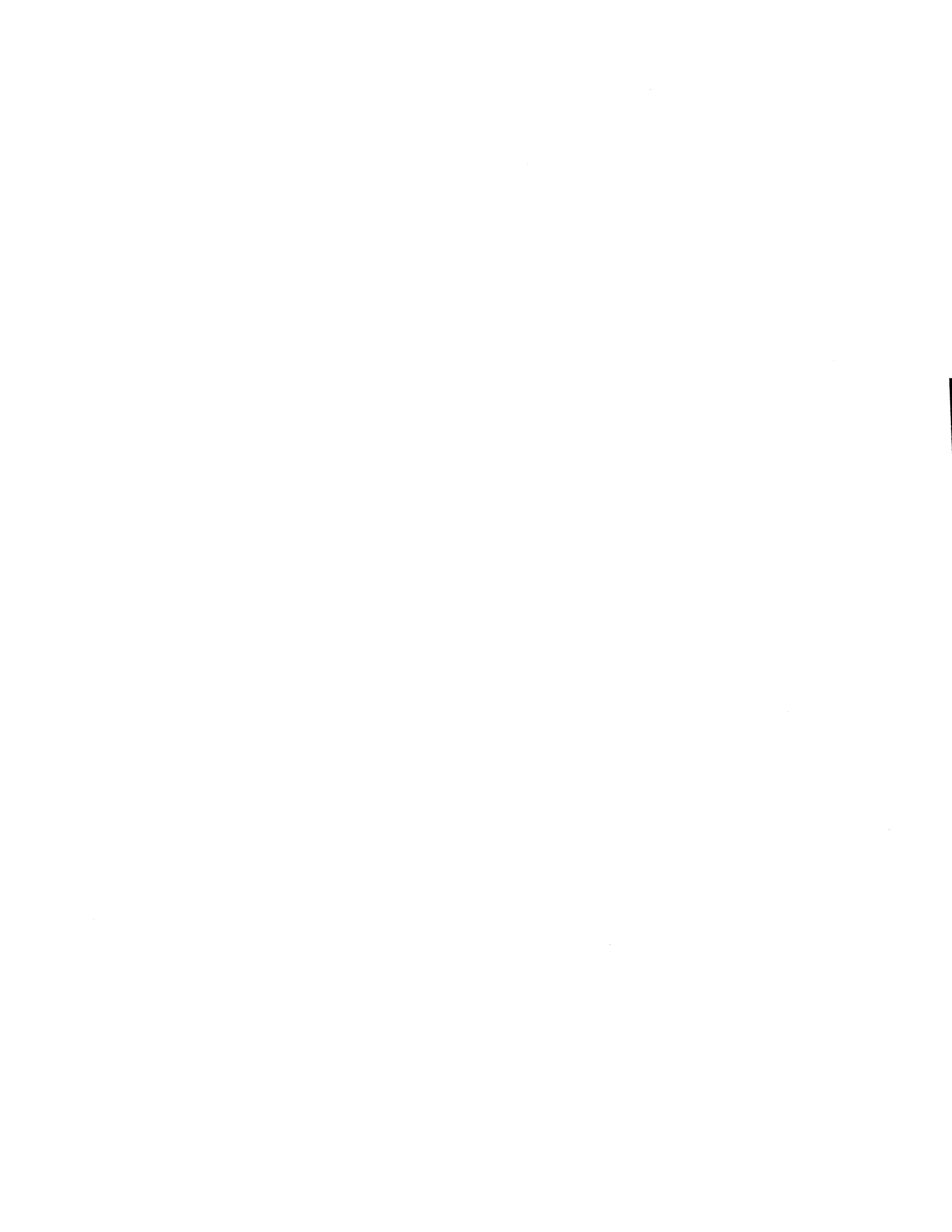
Liquid Pumped:	Drain water
Capacity (gpm):	57
Pump Total Head (feet):	41
Maximum Pump Speed:	1725 rpm
Motor Horsepower:	1
Variable Speed Drive Required:	No

3.05 FIELD TESTING

- A. Bump motor to ensure that motor has been connected for proper rotation.
- B. Demonstrate that the pumping units, motors, and control system meet the following requirements:
1. The pumping units operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.
 2. All automatic and manual controls function in accordance with the specified requirements.
 3. All drive equipment operates without being overloaded.
- C. Perform a draw down test to ensure the pump operates at the head and capacity specified.

END OF SECTION

DIVISION 14
CONVEYING SYSTEMS



SECTION 14551

SHAFTLESS SCREW CONVEYORS AND APPURTENANCES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, accessories and incidentals required and install and test, complete and ready for operation all shaftless screw conveyors including all supports and appurtenances as shown on the Drawings and as specified herein.
- B. Electric motors and capacitors shall be furnished as part of the work of this Section.
- C. The shaftless screw conveyors, shall be furnished as an integrated design, as the full responsibility of a single system supplier.

1.02 RELATED WORK

- A. Division 3 – Concrete Work
- B. Division 5 – Metals
- C. Division 9 – Finishes
- D. Division 15 – Mechanical Provisions
- E. Division 16 – Electrical
- F. Division 17 – 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 at least 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. Flight diameter and thickness of each screw.
 - 4. Trough diameter for each screw.
 - 5. Flight pitch of each screw.
 - 6. Rotating speed of each screw.
 - 7. Percentage of active trough area fill under design capacity for each screw.
 - 8. Details of bearings.

9. Calculations certified to by a professional engineer that:
 - a. Each auger is protected from overload when the auger's torsional loading exceeds 50 percent of its torsional rating.
 - b. At its torsional rating, the stress in each auger does not exceed 50 percent of the Fy value in the outermost extreme fiber of the flight material.
 10. The total weight of the equipment, the weight distribution when operating at maximum load and the weight of the single largest item or component.
 11. Weights to be carried at each support column, bracket, hanger or other structural member.
 12. A complete bill of materials for all equipment.
 13. A list of the manufacturer's recommended spare parts. Include gaskets, seals, etc, in the list.
 14. The recommended grades of lubricants along with alternative references to equal products of other manufacturers.
 15. Complete data on the motors and capacitors in accordance with Division 16.
 16. Certification that the gear box gears and bearings are in accordance with this Section.
 17. Description of shop surface preparation and prime paint.
 18. Operation and maintenance manual.
 19. Training Program.
- B. In the event that it is not possible to conform with certain details of this Section due to different manufacturing techniques, describe completely all nonconforming aspects.
- C. Operating and Maintenance Data
1. Copies of an operating and maintenance manual shall be furnished as provided in Section 01730. The manual 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 factory representative who has complete knowledge of proper operation and maintenance shall be provided for one 8-hour 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. 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 Iron and Steel Institute (AISI)
- B. American Institute of Steel Construction (AISC)
- C. American Gear Manufacturers Association (AGMA)
- D. National Electrical Manufacturers Association (NEMA)
- E. Anti-Friction Bearing Manufacturers Association (AFBMA)
- 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. All manufactured items provided under this Section shall be new, of current manufacture and shall be the products of reputable manufacturers specializing in manufacture and design of shaftless screw conveyors; such manufacturers shall have had a minimum of 5 years experience in design and manufacture of shaftless screw conveyors and shall, upon request of the Engineer, furnish the names of successful installations of its equipment of comparable nature to that offered under this contract. A minimum of twelve operating installations manufactured, designed and supplied by the equipment supplier, shall be required. All of these installations shall have been operating for a minimum of 3 years. Failure to furnish references acceptable to the Engineer will be cause of rejection.
- B. The shaftless screw conveyors shall be as manufactured by Spirac Engineering, Montville, NJ; (Purac Engineering), Wilmington, DE or equal.
- C. Should equipment which differs from this Section and/or the Drawings be offered and determined to be equal to that specified or shown, such equipment will be acceptable only on the basis that any revisions in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc, required to

accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer

1.06 SYSTEM DESCRIPTION

- A. All the equipment specified herein is intended to be standard equipment for use in screw conveyor systems for carrying screenings and grit and shall be installed as an integral part of the screenings and grit removal design as shown on the Drawings.
- B. The control of the conveyor is intended to provide for automatic starting of a conveyor directly related to the automatic bar screen and / or grit classifier and to stop the conveyor automatically when both the automatic bar screen and grit classifier has been stopped. Full manual start and stop control, with status lights, will be a control requirement; the conveyor drives will be interlocked with all associated emergency shut-downs.
- C. Control of the conveyors shall be provided through the automatic bar screen and grit snail / classifier.
 - 1. Conveyor drives shall all be constant speed.
- D. The overall dimensions of the shaftless screw conveyors and appurtenances shall fit within the space shown on the Drawings. Verify dimensions and clearances and coordinate the installation of the shaftless screw conveyors with the related work included in other Sections. Verify equipment supports, structure dimensions and arrangement and notify the Engineer of any discrepancy before submitting shop and erection drawings for approval. Coordinate all interfaces of the shaftless screw equipment with all related equipment specified in other related Sections. The shaftless screw conveyors shall comprise complete coordinated systems including, but not limited to: the shaftless screws, drives, troughs, supports, trough covers, liners, gear reducers, motors, discharge chutes, limit switches, motion sensors, and all appurtenances as shown on the Drawings or specified herein.

1.07 MAINTENANCE

- A. Tools and Spare Parts
 - 1. One set of all special tools required for normal operation and maintenance shall be provided. A minimum of two liner replacement tools shall be provided.
 - 2. The following spare parts shall be provided:
 - a. Sufficient wear stripping to completely replace the wear strips on the longest conveyor furnished

- b. One complete set of tools and fasteners to make repairs
- c. One complete set of all gaskets and seals for each sized chute provided. (Furnish within air-tight plasticene packaging)
- d. One replacement 3 Hp, C-faced motor
- e. Sufficient oil for reducer gearmotors to provide two oil changes or an 18 month supply, whichever is greater

1.08 LINER WEAR WARRANTY

- A. In addition to the equipment warranty required by the Contract Documents, each screw conveyor's trough liner shall not require replacement due to wear before 3,000 hours of operation or 18 months, after acceptance, whichever comes first. If any screw conveyor trough liner or segment thereof requires replacement due to wear, as evidenced within 3,000 hours of operation or 18 months after acceptance, whichever comes first, provide all labor and materials to replace the entire trough liner without additional cost to the Owner.
- B. Liner failure shall be defined by a loss of 25 percent or more of liner depth over a length of more than 0.25 times the flight diameter at any point within the trough; or a failure of the liner attachment method at more than one point on a given conveyor.

PART 2 - PRODUCTS

2.01 GENERAL

- A. This Section calls attention to certain features, but does not purport to cover all details of construction of the equipment. Furnish and install the equipment complete in all details and ready for operation.
- B. The shaftless screw conveyor systems shall be designed for both continuous and for intermittent operation at a capacity not less than that specified.
- C. The exact length of each conveyor will depend on the equipment selected. Ample room and facilities shall be provided for inspection, repairs, lubrication and adjustments.
- D. The shaftless screw conveyors shall convey screenings and grit in a neat, quiet, dependable, and nuisance-free manner. The equipment furnished shall have adequate capacity to convey the specified quantity of screenings and grit without failure and without exceeding the following trough filling:
 - 1. 50 percent active trough area for horizontal screw conveyors.

- E. The compatibility of the shaftless screw conveyor equipment and all other related equipment shall be the responsibility of the Contractor.
- F. The equipment shall be of high quality and of design and construction which, as a whole, will ensure satisfactory operation at all times under the conditions specified and satisfy the following requirements:
 - 1. There shall be no projecting set screws or other parts to endanger workmen. All devices required for the compliance with safety laws shall be provided.
 - 2. Sharp corners of all cut or sheared edges shall be smoothed by power grinders.
 - 3. Provision shall be made for ample and convenient lubrication of all machinery without danger of injury to the operators.
 - 4. All shafting shall be of ample diameter and provided with suitable bearings for the service required. Suitable means for making adjustment on parts subject to wear shall be provided where necessary.
 - 5. Installations shall be easy to maintain and keep clean. The equipment shall be capable of withstanding a daily washdown using high pressure water.
- G. Each conveyor shall be assembled to the greatest extent possible in the manufacturer's shop to ensure proper fitting of parts. Assembled sections shall then be matchmarked for field erection and disassembled prior to shipment. Deliveries shall be shipped in the maximum shipping lengths permitted.
- H. Furnish all required anchor bolts and other anchorage for the structure. Anchor bolts, nuts and washers shall be of Type 316 stainless steel unless otherwise specified.

2.02 SHAFTLESS SCREW CONVEYORS

- A. The shaftless screw conveyor system shall consist of the following:
 - 1. C-01 - 12-in diameter, horizontal, length 14-ft, flanged axial transfer, push drive, 5 Hp.
- B. The supporting framework for the conveyors shall be of AISI 304 stainless steel designed in conformance with the requirements of the latest revision of the AISC Standards for the Design, Fabrication and Erection of Structural Steel for Buildings, support loads shall be based on a completely filled trough plus dead weight of the equipment. Shop connections may be welded, riveted, or bolted. Supporting framework shall be in accordance with the following criteria:

1. The supporting framework shall be self supporting and designed to a minimum of twice the natural frequency of the screw conveyor unit under all loading conditions.
 2. The ratio of the unbraced length to the least radius of gyration (slenderness ratio) shall not exceed 120 for any compression member and shall not exceed 240 for any tension member (of angles about the Z-Z axis).
 3. All structural members and connections shall be designed so that the unit stresses will not exceed AISC allowable stresses by more than 1/3 when subject to loading of twice the running torque of the drive motor.
- C. The support framework shall be designed and constructed such that each conveyor is independently supported.
- D. Supports shall be provided near the drive units (approximately 1 to 2-ft) and at a quantity of not less than one for every 8-ft (or part thereof) of length of trough segment; provide a support adjacent to each transfer or discharge.
- E. A separate support consisting of the same size and thickness of materials shall be integrally welded to the trough at the drive end to support the screw conveyor drive weight. A separate similar support foot shall be welded to the end face of the last segment of the trough of each screw conveyor.
- F. Supports shall be constructed of AISI 304 stainless steel using welded construction with bolted connections to conveyor casings, feet and support points. Field connections shall be bolted using reamed, subpunched holes and finished bolts as follows:
1. Supporting members attached to concrete shall be by minimum 1/2-in diameter Type 304 stainless steel anchor bolts. A minimum of two bolts shall be used per supporting member.
 2. Supporting members attached to structural steel elements shall be by minimum 1/2-in diameter Type 304 stainless steel hex bolts with one flat washer and one lock washer. A minimum of two bolts shall be used at each connection point.
- G. Cover plates for shaftless screw conveyors shall be provided along the entire conveyor length to contain splatter. Conveyor trough covers shall be clamped covers of 3/32-in, Type 304 stainless steel single-piece formed sheet metal, not greater than 40-in in length, and attached to the screw conveyor trough using toggle clamps. Such clamps shall require no tools to place or remove and when disconnected, such clamps shall not allow any of their parts to become detached from the conveyor trough. Trough covers are to be complete with turned-down edges parallel to the sides of the

screw conveyor trough flange and turned up at 90 degrees for receiving a clamping bar at cover joints. Clamps shall be at less than 32-in centers along the length of the screw conveyor trough. Each cover section shall have two handles for ease of removal. The handles shall be made from 3/8-in diameter Type 304 stainless steel and formed into a "U". The handles shall be welded to the covers to a pre- drilled, Type 304 stainless steel backing plate. The backing plate shall be welded to the cover as reinforcing. The handle shall be fully welded to the cover and to the backing plate. Each conveyor trough cover shall be equipped with a wear strip manufactured from the same material as the liner attached to the underside of the cover. This strip shall be used to restrain vertical movement of the flights. In lieu of the strip attached to the covers, alternate holddown provisions may be provided as designed by and recommended by the conveyor manufacturer. A minimum 3/32-in Neoprene gasket of 50 Durometer shall be applied with an appropriate adhesive to the mating surfaces of the trough covers. Trough covers shall be provided with welded flanged stub connections at locations shown on the Drawings, for connection to ventilation/odor control systems.

- H. Spiral flighting for the shaftless screw conveyors shall be designed to convey material without a center shaft. The spiral flights shall be designed with the stability to prevent distortion and jumping in the trough while operating at design capacity. The spiral flighting shall be cold formed spring steel of minimum hardness 200 Brinell. The spiral flighting design shall be such that the maximum allowable stress in the extreme fiber does not exceed 0.5 Fy, 0.2 percent offset, under torsional loading at brake horsepower requirement. The outer spiral shall be a minimum of 2-1/2-in by 3/4-in. The flight shall be formed in a spiral forming machine to the diameter and pitch specified within a tolerance of plus or minus 0.080-in from the theoretical for both pitch and diameter.
- I. Spiral flighting shall have full penetration welds at all splice connections. The flights shall be aligned to assure true alignment when assembled and shall be made according to the manufacturer's recommendations. The spiral flights shall be connected to the drive system through a flanged connection plate that is welded to the spiral forming a smooth and continuous transformation from the flange plate to the spiral. The drive shaft shall have a mating flange and shall be bolted to the spiral connection plate. A gland packing ring consisting of teflon coated packing rings shall seal the drive shaft at its penetration through the end plate. The flanged connection shall be welded to the spiral flights with welded gusset plates for additional reinforcing. If necessary, bushings shall be used between the pipe sleeve and the end shaft. Neither end nor intermediate bearings will not be allowed. A compression packing gland shall be provided around the shaft at its penetrations through the trough end plates. Snap rings shall make the bearings and seals capable of supporting maximum thrust loads and preventing angular misalignment of the shafts.

J. Conveyor troughs shall be fabricated from minimum 3/16-in thick Type 304 stainless steel. At the drive end of each trough, provide a minimum 5/8-in thick Type 304 stainless steel end plate and drive support base of all welded construction upon which the conveyor drive assembly shall be mounted. Trough segments shall consist of rolled sections with flanges butt welded together. The maximum length of a single segment shall not exceed 20-ft in length. The rolled trough sections shall have the specified diameter within a tolerance of plus or minus 0.010-in. Trough end flanges shall be roll formed of minimum inch by 3/8-in thick Type 304 stainless steel bar welded to the ends of the trough segments. Transition flange offset angles shall be accurate to plus or minus 0.25 degrees. Bolt holes for joining trough sections shall be located on the centerline of the roll formed flange within a tolerance of plus or minus 0.005-in of the theoretical radius centerline and at distances between adjacent bolt holes as shown on the Drawings with a tolerance of plus or minus 0.010-in. Bolt holes shall be uniformly located on either side of the trough's vertical centerline. A minimum 1/8-in Neoprene gasket of 50 Durometer shall be applied with an appropriate adhesive to flange faces. Alternatively, an approved compressible flow type string gasket material shall be applied to the flange faces. Support feet shall be provided at each vertical support location. Each support shall be made of Type 304 stainless steel. The dimensions and arrangement of the steel members for the support feet shall be as recommended by the conveyor manufacturer.

1. Trough stiffener channels made from Type 304 stainless steel approximately 2-1/2-in wide by 7/8-in deep by 1/8-in thickness shall be installed across the width of all troughs at a maximum center-to-center distance of 40-in. Each trough stiffener channel shall have down turned end. Each down turned end shall be drilled for, and bolted with a Type 304 stainless steel bolt. The trough stiffener channels' center to center spacing shall be set to seal the faces upon which the rough covers and chutes are bolted. Trough stiffener channels shall be bolted in place prior to shipment from the manufacturer.

K. The conveyor troughs shall be equipped as follows:

1. Each inclined screw conveyor trough shall have a 3-in diameter dewatering pipe connection at its lower end for connection to the Dewatering Building drainage system. Pipe connection shall be fitted with a 90 degree bend, horizontal extension and gate valve located in such a manner to provide easy access for pipe or hose connection to floor drain. Horizontal extension and gate valve shall not present a tripping hazard.
2. The last trough cover of each inclined conveyor (discharge end) shall have a 3/4-in male hose thread of Type 304 stainless steel welded thereto to provide hose connection for flushing and water lubrication. The weldament shall be located at the center of the cover, approximately 1.5-ft upflow of the conveyor discharge. Weld shall be continuous and free of voids.

- L. Shaftless screw conveyor liner material shall be an industrial plastimeric material minimum 1/2-in thickness. The liner shall extend the full length of the trough, covering the entire semicircular bottom portion of the trough.
1. The liner material shall meet or exceed the following requirements.
 - a. Yield strength at 75 degrees F: 5,000 psi
 - b. Ultimate tensile strength at 75 degrees F: 8,500 psi
 - c. Break elongation at 75 degrees F: 250 percent
 - d. Dynamic coefficient of friction when running dry against polished steel: 0.10, work hardened: 0.08
 - e. Resistant against acids, grease and chemicals, no water penetration.
 2. Liner material shall be an ultra high molecular weight (UHMW) polyethylene Duraslide Xylethon manufactured by Durawear Corp. or equal.
 3. The liners shall be installed as parallel strips, and shall be secured at intervals not to exceed 10-ft, using Type 304 stainless steel retaining clips of an approved design.
- M. Each trough shall be equipped with filling and/or discharge chutes for transferring material to or from another conveyor and receiving sludge cake from the belt filter press discharge chute. Provide Type 316L stainless steel bolts and suitable gaskets for all flanged connections with other conveyors. Equal level transfers shall be utilized as indicated in Paragraph 2.02A above.
1. Chutes shall be of all welded construction and be fabricated from at least 10 gauge Type 304 stainless steel. The juncture of all joints in plates shall be continuously seal welded inside and out so that the chutes are watertight. External stiffening ribs shall be provided as required to limit stresses and deformation in plates during shipping, installation and operation. Filling chutes from the (the dewatering) (screening) equipment shall be supported from the conveyor trough or support framework but not from the equipment itself.
- N. Each screw conveyor shall be driven by an electric motor connected to a gear reducer. The gear reducer shall be mounted to the trough end. The drive system shall be designed for starting the conveyor fully loaded. Drive size shall be as recommended by the manufacturer. All electric motors shall be totally enclosed and fan cooled. Motor input and drive output shall be perpendicular.
1. The drive motors shall be horizontal, severe duty, 1.15 service factor, NEMA Design B and shall conform to the motor specification in Section 01171. Horsepower shall be as determined by the conveyor manufacturer to be adequate to drive the equipment under all operating conditions but shall not

exceed 3 Hp for horizontal shaftless screw conveyors and shall not exceed 5 Hp for inclined shaftless screw conveyors. Motor speed shall not exceed 1750 rpm. The service factor shall not be reduced under normal maximum loadings.

- O. All gear reducers shall be commercially built, to minimum Quality Class No. II per AGMA Standard 390.03 Gear Classification Manual. Gear reducers shall be single or double reduction, helical gear units with high capacity roller bearings. Gears shall be made of alloy steel, protuberance hobbed, gas carburized, oil quenched hardened, steel shot peened and ground, with a surface hardness after grinding of Rockwell RC-60 or greater and meeting the requirements of AGMA Standard 218.01. Gear reducers shall be suitable for the loading conditions imposed on the input shaft in the mounting arrangement shown on the Drawings. The gear reducers shall be suitable for continuous duty service with moderate shock loadings and sized at the gear reducer's output shaft speed for not less than the greater of:
1. 1.5 times the break horsepower at the gear reducer output shaft.
 2. 1.0 times the name plate motor horsepower of the drive motor.
 3. Bearings shall be designed for the thrust loads from the spiral flights and shall have an AFBMA B-10 life of 30,000 hours. The reducers shall be standard oil lubricated, air-cooled units with no auxiliary cooling allowed. Low speed output shaft shall be chrome plated. Shaft seals shall be triple lipseal with taconite packing designed for severe conditions. The gear reducer housing shall be cast iron with removable inspection covers, oil breathers, oil level indicators and oil drain plugs. Gear reducers that are shipped from the factory without an initial factory oil fill shall be adequately treated or coated before shipment to protect the units during shipment and storage. Prior to installing the units, they shall be drained, flushed and filled with oil.
- P. Each conveyor shall be equipped with a motion failure alarm unit. The location and mounting details of these sensors shall be as recommended by the conveyor manufacturer and approved by the Engineer. Motion sensors shall be the non-contacting type using a probe with pre-amplifier and main electronic assembly. The probe shall be totally enclosed so it is impervious to dust and moisture. The pre-amplifier, if part of the probe, shall also be sealed. The operating temperature range shall be minus 40 to plus 140 degrees F. The probe shall be able to detect a moving ferromagnetic material from 1 to 2-in away. The ferromagnetic material shall be sensed during each rotation of the conveyor spiral and the probe shall produce a voltage pulse. This pulse shall be processed by the pre-amplifier which is wired to the main electronic unit. The main electronic unit shall operate on 120 Volt, single phase, 60 Hz power supply and shall be housed in a NEMA 4X enclosure. A 0

to 60 second time delay shall be provided to allow start-up of the screw conveyor. The output shall be two form C contacts for remote alarm.

- Q. Each conveyor shall be furnished with emergency trip cord and trip switch. The safety trip cords shall be provided along both sides of each conveyor. Trip switch shall immediately stop conveyor when trip cord is pulled.
- R. All necessary supports for the conveyors and the drive motors shall be provided by the manufacturer with the conveyor.

2.03 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A. Surface preparation and shop priming shall be part of the work of this Section and shall be as specified in Section 09901. Field painting is included in Section 09902. Ensure that shop painting and field painting are compatible. Stainless steel shall not be painted.

2.04 SHOP TESTING

- A. Each conveyor shall be fully shop assembled and tested for conformance to the specified requirements, modified to reflect the use of a substitute material for the (screenings and grit) of similar density and fluidity.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The equipment shall be installed in accordance with the instructions and recommendations of the manufacturer and as indicated on the Drawings. Coordinate the equipment with the requirements of the related centrifuges to obtain a complete, integrated and satisfactory operating installation of the conveying equipment.
- B. 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 furnished by the equipment manufacturer and set by the Contractor in accordance with the manufacturer's recommendations and setting Drawings.

3.02 INSPECTION AND TESTING

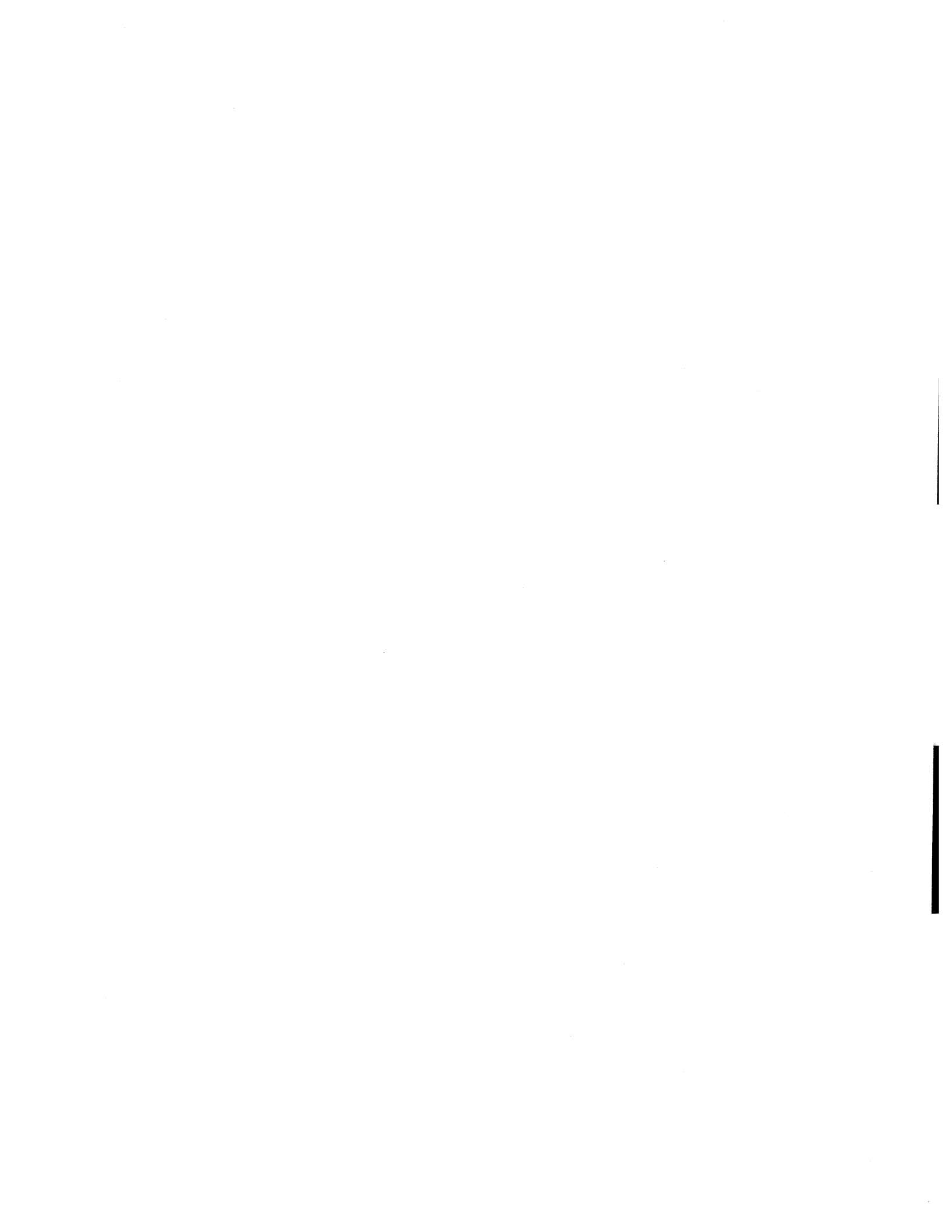
- A. Furnish the services of a qualified factory representative as provided in Paragraph 1.06 above, to inspect the final installation and supervise testing of the equipment.

- B. Upon completion of installation, the conveyors shall be operated by the Contractor in the presence of the Engineer to demonstrate the ability of the conveyors to operate smoothly and the drive unit to operate continuously without noise, vibration or generation of excessive heat. The test shall also indicate no other apparent deficiencies in the system. The slide gates will be tested for jam free operation on opening and closing. Each gate will be cycled a minimum of twenty times and shall operate smoothly prior to acceptance.

3.03 FINAL ACCEPTANCE TESTING

- A. A Final Acceptance test shall be made under regular operating conditions to further demonstrate the ability of the conveyors to convey the screenings and grit hoppers and discharge it to the dumpsters, for a period of not less than 200 operating hours.
- B. Any deficiencies found in the equipment shall be remedied by the Contractor at no additional cost to the Owner.

END OF SECTION



DIVISION 15
MECHANICAL

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.

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

pipng 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.
- 2. See Paragraph 2.03 for duct hangers and supports.

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.

2.03 DUCT SUPPORTS AND HANGERS

A. General

- 1. Unless specified otherwise, all components of the duct support and hanger system shall be of Type 316 stainless steel, including anchors and rods.

2. Ductwork shall be adequately braced and supported to resist the wind loads of 20 pounds per square feet on the projected surface as required by the Uniform Building Code.
- B. Ceiling Supported Ducts
1. Ducts supported from the structure shall be supported using fabricated half-clamps and hanger rods suspended from the ceiling.
 2. Half-clamps shall be stainless steel, Grinnell Hanger Standard 38, Type B, or equal.
 3. Hanger rods shall be machine-threaded stainless steel rods with stainless steel nut on one end and stainless steel turnbuckle on the other end.
 4. Duct hanger assemblies shall be suspended from structure using stainless steel wedge anchors.

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 09900 Heavy Duty Finishes.
- B. Finish coating is included in Section 09900 - Heavy Duty Finishes.

END OF SECTION

SECTION 15120

PROCESS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish, install, and test all process pipe, fittings, and appurtenances as specified and indicated.

1.02 RELATED WORK

- A. Section 02615 – Ductile Iron Pipe & Fittings
- B. Section 02617 – Installation and Testing of Pressure Pipe
- C. Section 02622 – PVC Pipe and Fittings
- D. Section 02640 – Valves and Appurtenances
- E. Section 09900 – Heavy Duty Finishes
- F. Section 15110 - Pipe Hangers and Supports

1.03 SUBMITTALS

- A. Certificates - Submit manufacturer's certificates of conformance.
- B. Test Reports - Submit certified copies of test reports.
- C. Layouts - Submit layouts and details of connections and terminations for all containment piping and alarms.

1.04 REFERENCE STANDARDS

- A. American Welding Society (AWS) - AWS 30
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A47 - Ferritic Malleable Iron Castings.

2. ASTM A120-82 - Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
3. ASTM A181-81 - Standard Specification for Forgings, Carbon Steel, for General Purpose Piping.
4. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
5. ASTM A307-82a - Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.
6. ASTM B62-82 - Standard Specification for Composition Bronze or Ounce Metal Castings.
7. ASTM B75 - Standard Specification for Seamless Copper Tube.
8. ASTM B88-83 - Standard Specification for Seamless Copper Water Tube
9. ASTM D2564 - Standard Specification for Solvent Cements for Polyvinylchloride (PVC) Plastic Piping System.
10. ASTM D2865 - Making Solvent - Cemented Joints with Polyvinylchloride (PVC) Pipe and Fittings.
11. ASTM D3212-86 - Specification for Joints for Drain and Sewer Plastic Pipe Using Flexible Elastic Seals.
12. ASTM F477-87 - 1985 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
13. ASTM F679-86 - Specification for Polyvinylchloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.

C. American National Standards Institute (ANSI)

1. ANSI A21.10 - 1987 Ductile Iron and Gray Iron Fittings 3-inch Through 48-inch for Water and Other Liquids.
2. ANSI A21.11 - 1985 Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe Fittings.
3. ANSI A21.15 - 1988 Flanged Ductile Iron Pipe with Threaded Flanges.

4. ANSI A21.50 - 1986 (R86) Thickness Design of Ductile Iron Pipe.
 5. ANSI A21.53 - 1988 Ductile Iron Compact Fittings 3-inch Through 16-inch for Water and Other Liquids.
 6. ANSI B16.1 - 1975 AN Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 25, Class 125, Class 250 and Class 800.
 7. ANSI B16.42 - 1987 AN Standard for Ductile Iron Pipe Flanges and Flanged Fittings.
 8. ANSI B16.5 - 1981 AN Standard for Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
 9. ANSI B16.42 - 1987 Ductile Iron Pipe Flanges and Flanged Fittings
- D. American Water Works Association (AWWA) Standards
1. AWWA C606-87 - Grooved and Shoulder Joints.

1.05 QUALITY ASSURANCE

- A. Install piping to meet requirements of all state and local codes.
- B. Provide manufacturer's certification that material meets or exceeds minimum requirements as specified.
- C. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner, and acid solder. Reject any PVC or PE pipes with visible signs of UV damage due to improper storage.
- D. Pipe-joint compound, for pipe carrying flammable or toxic gas, must bear approval of Underwriters' Laboratories or Factory Mutual Engineering Division.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Store and safeguard material in acceptable place and manner and in accordance with manufacturer's written recommendations.

PART 2 - PRODUCTS

2.01 INSTALLATION MATERIAL - GENERAL

- A. Solid String or Wire Solder - 95 percent tin and 5 percent antimony, inside piping; and silphos solder, underground piping.
- B. Flanged Joints - Bolts and nuts, Grade B, ASTM A307-78; bolt number and size name as flange standard; studs - same quality as machine bolts; 1/16-inch thick rubber gaskets with cloth insertions; rust-resistant coatings.
- C. Sleeve Type Couplings or Fittings - 3/4-inch tie rods, 3/4-inch bridles, pipe clamps.
- D. Temporary Plugs - Plugs or caps; watertight plugs for exterior buried piping.
- E. Sleeve Type Couplings
 - 1. Style 38 couplings manufactured by the Dresser Manufacturing Division, Bradford, Pennsylvania or approved equal.
 - 2. Series 200 couplings manufactured by Baker Coupling Company, Inc., Los Angeles, California. or approved equal.
 - 3. Provide coupling with stainless steel bolts, nuts and washers. Gaskets suitable for use with potable water or approved equal.
- F. Wall Sleeve Seals
 - 1. Provide a ductile iron sleeve with waterstop capable of being bolted directly to the formwork to prevent misalignment. Provide a confined rubber gasket to seal the annular space between carrier pipe and sleeve. Omni Sleeve, Malden, Massachusetts or approved equal.
 - 2. Compression type units with molded rubber links and bolt holes, elongated back-up washers, nuts and bolts. Link-Seal by Thunderline Corporation, Wayne, Michigan or approved equal.
- G. Flexible Connections - Flanged spool type, Standard Class 1 180 degrees Fahrenheit maximum service, single filled arch with synthetic rubber tube and cover, steel-ring reinforced asbestos or synthetic fiber carcass, with flanges drilled to 150 pounds. ANSI B16.5 Standard. Garlock, Mercer, Red Valve, or equivalent.

2.02 STAINLESS STEEL PIPE AND TUBING

- A. Pipe – Stainless Steel, Type 316L with maximum of 0.03% carbon.
- B. Tube - Seamless, annealed Type 316 stainless steel OD tubing conforming to ASTM A269.
- C. Fittings - Type 316 stainless steel compression type fitting. Tube fitting shall consist of 4 machined pieces (i.e., body, front ferrule, back ferrule and nut). Manufactured by Swagelok Company, Solon, Ohio or equivalent.

2.03 SLEEVE TYPE COUPLINGS

- A. Manufacturers
 - 1. Style 38 couplings made by the Dresser Manufacturing Division, Bradford, Pennsylvania.
 - 2. Series 200 couplings manufactured by Baker Coupling Company, Inc., Los Angeles, California.
- B. Provisions - Couplings provided with galvanized steel bolts and nuts and gaskets of composition suitable for exposure to potable water.

2.04 EXPANSION JOINTS

- A. Omniflex expansion joints are to be of the Depend-O-Lok series made by Brico Industries, Inc., Georgia, for air piping joints. To be installed as shown on the Drawings.
- B. Paragon expansion joints are to be of the Depend-O-Lok series made by Brico Industries, Inc., Georgia, for liquid piping joints. To be installed as shown on the Drawings.
- C. Expansion couplings are to be of the Depend-O-Lok series made by Brico Industries, Inc., Georgia. Air piping is to use the Air Master model and liquid piping is to use the Fluid Master model. To be installed as shown on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE - GENERAL

- A. Ensure interior lines parallel to building walls wherever possible. Install piping to accurate lines and grades, and support by acceptable hangers spaced as necessary, but not more than 8 feet apart. Pipe supports specified under Section 15060 - Pipe Hangers and Supports. Where temporary supports are used, ensure rigidity to prevent shifting or distortion of pipe. Provide for expansion where necessary.
- B. Support piping laid in trenches in trench on bed of selected backfill material which maintains desired line and grade.
- C. Pitch all piping toward low points. Provide for draining low points.
- D. Before assembly, remove all dirt and chips from inside pipe and fittings and from threads.
- E. After cutting to final lengths, ream ends of steel pipe and ream copper tubing to remove burrs.
- F. Clean cut threads of all long tapered screwed joint. Make up screwed joints with acceptable pipe-joint compound applied to male threads only.
- G. Disjoint entirely joints which are required to be backed off. Wipe clean threads of both pipe and fittings. Apply new joint compound. Reassemble connection.
- H. No close nipples allowed.
- I. Prepare solder joints for copper tubing by cleaning ends of tubing and inner surfaces of fittings with steel wool until bright. Give cleaned surfaces thin coating of acceptable soldering flux, and insert tubing end into fitting as far as possible. Heating and finishing of joint done in accordance with recommendations of manufacturer of the fittings, using solid string or wire solder composed of 50 percent tin and 50 percent lead inside, and 95 percent tin and 5 percent antimony underground. Use of cored solder not permitted.
- J. Cut and burr flared joints for copper tubing. Slip sleeve nut on tubing and flare end with flaring tool. Take care not to crack or split flared portion. If inspection reveals damage, cut flare off and make new flare. Seat flared end squarely on fitting and tightened nut.
- K. Use dielectric bushings or unions when ferrous pipes joint nonferrous pipes carrying liquid either underground or elsewhere.

- L. Use sufficient number of unions for dismantling of all water pipe, valves, and equipment. 250 WSP Unions made of brass or bronze for joining nonferrous pipe and malleable iron or steel with brass or bronze seats for joining ferrous pipe.
- M. Welding in accordance with AN Standard B31 and AWS B3.0.
- N. All field welding shall be butt welded per the general guidelines of ASTM D-2657 for polyolefin piping, and in accordance with the manufacturer's printed guidelines. All welding parameters shall be computer controlled to provide consistency of the welds. Fully automatic closed loop control shall apply the various pressures required throughout the entire welding procedure. Welding shall be automatically prohibited by the computer if certain pre-set time and/or temperature are not met.
- O. Install welding fittings on all welded lines. Make changes in direction and intersection of lines with welding fittings. Do not miter pipes to form elbows or notching of straight runs to form tees, or any similar construction. Do not employ welder who has not been fully qualified in above specified procedure and so certified by approved welding bureau or similar locally recognized testing authority.
- P. Make flanged joints with bolts; bolt studs with nut on each end; or studs with nuts where one flange is tapped. Number and size of bolts conforming to same AN Standard as flanges. Grade B bolts and nuts conforming to ASTM A307-78. Both studs and studs of same quality as machine bolts. Ring gaskets of rubber with cloth insertion, 1/16-inch thick gaskets. Before flanged pieces are assembled, remove rust-resistant coatings from machined surfaces, clean gaskets and smooth all burrs and other defects. Make up flanged joints tight, care being taken to prevent undue strain upon valves or other pieces of equipment.
- P. Install tie rods, pipe clamps or bridles when sleeve type couplings or fittings are used in piping system where indicated, and at changes in direction or other places as necessary, to prevent joints from pulling apart under pressure. Bridles and tie rods at least 3/4-inch in diameter, except where tie rods replace flange bolts of smaller size, in which case fit with nut on each side of pair of flanges.
- Q. Connections between containment pipe and non-containment pipe to be with flanges.

3.02 TEMPORARY PLUGS

- A. Close open ends of pipe with temporary plugs or caps when pipe installation is not in progress. Use watertight plugs for exterior, buried piping and if water or debris is in trench when work is resumed, do not remove until adequate provision has been made to prevent any water or debris entering pipe even if it necessitates dewatering trench.

END OF SECTION

DIVISION 16
ELECTRICAL

1

2

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 applicable provisions of Division 1 through 17 Specification Sections, apply to this Section as if specified herein.

1.02 ABBREVIATIONS

- A. HMI – Human Machine Interface.
- B. OEM – Original Equipment Manufacturer.
- C. PLC – Programmable Logic Controller.
- D. SCADA – System Control and Data Acquisition.

1.03 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. “Materials” shall be understood to include all systems, equipment, apparatus, components, devices, assemblies, sub-assemblies, accessories, and appurtenances.
- C. “Owner” shall be understood to include the Owner’s Designated Representative.
- D. “Or equal” and “or approved equal” shall be understood as “or approved equal prior to the bid.”
- E. “Provide” shall be understood as “furnish and install.”
- F. The “Work” shall be understood as the “Work of this Project.”

1.04 BASIC REQUIREMENTS

- A. Codes/Standards Compliance: Electrical installations shall comply with the applicable requirements and advisory provisions of the following:
 - 1. ANSI – American National Standards Institute.
 - 2. NECA – National Electrical Contractor’s Association:
 - a. National Electrical Installations Standard.
 - 3. NEMA – National Electrical Manufacturer’s Association.
 - 4. NETA – International Electrical Testing Association.

5. NFPA – National Fire Protection Association:
 - a. 70 - National Electrical Code (NEC).
 - b. 72 – Fire Alarm Code.
 - c. 101 – Life Safety Code.
 - d. 780 – Lightning Protection Code.
6. IEEE - Institute of Electrical and Electronic Engineers:
 - a. National Electrical Safety Code (NEC).
 - b. Std 142 (Green Book) – Grounding.
7. UL – Underwriter’s Laboratories.

In additional to the codes/standards enumerated above, electrical installations shall comply with all governing laws and regulations of the State of Florida as interpreted and enforced by the AHJ. Where, in any specific case, referenced codes/standards, the laws and regulations of the State of Florida, the Specifications or the Drawings specify different materials and/or methods of construction, the most restrictive requirements shall govern and shall be provided by the Contractor with no additional compensation.

- B. Contractor’s Charge: It shall be this Contractor’s responsibility to furnish all electrical materials, tools and transportation, and perform all services and labor required to complete the Work as conveyed in the Specifications and on the Drawings. The Work as conveyed on the Drawings shall be followed as closely as actual conditions will permit.
- C. Drawings: The Drawings are diagrammatic and are not intended to show all raceway, wiring, exact locations of equipment, terminations, or number or types of fittings required. Since the drawings of floor, wall, and ceiling installation are made at a small scale, outlets, devices, equipment, etc. are indicated only in their approximate location unless dimensioned or otherwise indicated. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinate such locations with the work of other trades to prevent interferences. Do not scale the drawings. Refer to architectural, structural, and mechanical drawings for dimensions as applicable.
- D. Site Inspection: Prior to the bid, the Contractor shall inspect the Project Site and shall become thoroughly familiar with the existing site conditions and include in their bid the additional equipment, materials and manpower required to complete the Work. The Contractor shall carefully study and compare the Drawings with the actual site conditions and shall, before the submission of their bid, notify the Owner’s Designated Representative of any error, inconsistency or omission discovered. If the successful Contractor proceeds with the Work without such notification, having discovered such errors, inconsistencies or omissions, or if by reasonable study of the Contract Documents the Contractor could have discovered such, the Contractor shall

bear all costs arising therefrom.

- E. Hazardous Materials/Conditions: Advise the Owner 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.
- F. Workmanship: All work must be performed in a neat and workmanlike manner using the best methods known to the trade, and shall present a neat and professional appearance when complete. All electrical installation work must be performed by a licensed journeyman electrician or a certified apprentice working under the direct supervision of a licensed journeyman electrician. The Contractor shall include in his bid the equipment, material and manpower to accomplish all cutting, patching and fitting required to complete the Work, or otherwise make several parts fit together properly.
- G. Onsite Storage: Onsite storage of materials, and tools will be at the Owner's discretion and the Contractor's risk. The Contractor shall follow the haul routes and pathways as directed by the Owner for the movement of materials and tools in and out of Project Areas, and to and from the Project Site. Such pathways will be established by the Owner, and are subject to change at the Owner's discretion.
- H. Delivery, Storage, and Handling: 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, and so as to ensure the preservation of their quality and fitness. In all cases, such protection shall be 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. Handle materials in accordance with manufacturer's published instructions. Handle materials carefully to avoid damage to internal components, enclosure, and finish.
- I. Maintenance of Work Areas: The Contractor shall maintain all work areas in a neat and orderly fashion. 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.
- J. Complete, Operational, and Fully Functional Installations: Unless otherwise noted, the Contractor shall provide specified materials complete with all fittings, supports, trims, and related components and appurtenances necessary for complete, operational, and fully functional installations.
- K. Protection of Materials: Protect existing and new installations against damage due to movement of equipment and materials and other construction activities. Electrical materials, especially raceways and supporting structures for raceways and lighting fixtures, shall not be used as access scaffolding. The Contractor shall exercise great care to prevent damage to materials during installation and throughout the course of construction. Materials damaged during installation or throughout the course of construction shall be repaired and/or replaced by the Contractor at the Contractor's expense, to the satisfaction of the Owner.
- L. Protection of Factory Finishes: Protect existing and new installations against damage

due to movement of equipment and materials and other construction activities. The Contractor shall exercise great care to prevent damage to factory finished materials during installation and throughout the course of construction. If factory finish is damaged, the entire surface of the equipment, device, component or cabinet shall be refinished by the Contractor at the Contractor's expense, to the satisfaction of the Owner.

- M. Power Outages: The Contractor shall schedule power outages as required to complete the Work. The number and duration of power outages shall be kept to an absolute minimum. Power outages must be coordinated and scheduled with the Owner in accordance with Owner established procedures.
- N. Temporary Power and Lighting: Follow all OSHA requirements for construction site safety related to temporary power and lighting. Provide temporary lighting throughout the Project Site in sufficient quantities so as to meet OSHA recommended illumination levels. Maintain temporary lighting for the entire construction period. As a minimum, perform a daily inspection of temporary power and lighting systems. Repair and/or replace damaged receptacles, cut, frayed or otherwise damaged power cords, damaged temporary lighting fixtures and burned out lamps as soon as the damaged item is discovered. Provide temporary ground fault circuit interrupter type receptacles in appropriate quantities and at such locations throughout the Project Site so as to limit power cord lengths to a maximum of 50 feet. Provide separate self-contained portable generators as required to support arc welders and similar tools. Do not power arc welders or similar tools from equipment served by Utility service drops.
- O. 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.
- P. Contractor's Warranty: The Contractor shall guarantee electrical installations against defects in materials and workmanship for a period of one year following notification of Substantial Completion. The Contractor's Warranty shall cover all parts, labor, transportation and shipping and handling costs and expenses as required to effect the repair or replacement of defective elements of electrical installations provided in connection with this Contract. Regardless of the Contractor's Warranty, manufacturer's standard and special product warranties for systems provided in connection with this project shall be provided and shall remain in full effect. Contractor's Warranty shall stipulate that Contractor response to requests for service shall not exceed the following:
 - 1. 24 hours for non-emergency requests for assistance that require Contractor personnel to be on-site.
 - 2. 4 hours for emergency requests for assistance that require Contractor personnel to be on-site.

1.05 PRODUCTS

- A. General: Provide materials that are listed and labeled as defined in the NEC, Article 100, by a testing agency acceptable to the AHJ. Materials described by the Contract Documents establish the minimum standards for quality and style and shall be the basis of the bid. Materials shall be installed in accordance with the material manufacturer's recommendations using the best methods known to the trade. All materials shall be listed and labeled by UL (Underwriters' Laboratories, Inc.) as conforming to its standards, where such a standard has been established by UL for the particular type of material in question. Where no such standard has been established by UL for the particular type of material in question, provide the services of a testing agency acceptable to the AHJ, to field inspect, test and certify the electrical material as suitable for use in its installed condition.
- B. No materials or apparatus may be substituted after the bid opening, except where the item has been discontinued.

1.06 SUBMITTALS

- A. Comply with the general requirements of the Contract governing submittals and the following:
1. Clearly identify all submittals with project name and location, product manufacturer's name, product catalog number, specification section(s) governing submittal, company name (Contractor), reviewer name (Contractor) and date reviewed. Review and approve all submittals prior to submitting to the Engineer. Submittals not so marked and approved will be rejected by the Engineer without review, and resubmittal will be required.
 2. Product data shall consist of catalog cut sheets, brochures, circulars, specifications, performance data, installation instructions, control and wiring diagrams and printed information in sufficient detail and scope to verify compliance with the requirements of the Contract Documents. Clearly mark product data copies to identify pertinent products, models, part numbers, features and options being proposed. Cross-out products, models, part numbers and options that are not being proposed. Identify performance characteristics, capacities, dimensions and required clearances.
 3. Shop Drawings: Shop Drawings for materials that are laid out, configured or designed by the manufacturer shall be submitted to the Engineer for review and comment. Comments made by the Engineer on the Shop Drawings shall be incorporated on the Shop Drawings prior to the release of the Shop Drawings for manufacturing.
 4. Submittals for similar materials shall be packaged together as a single

submittal. Submittals for separate elements of a single system or item of equipment shall be packaged together as a single submittal.

5. Make resubmission on submittals returned to the Contractor not marked "CONFORMS WITH CONCEPT" or "CONFORMS AS NOTED (RESUBMISSION NOT REQUIRED)." The Contractor shall make resubmission with no additional compensation. No products or assemblies are to be ordered or manufacturing, fabrication, or assembly begun until the submittals for the products or assemblies in question are returned to the controls supplier marked "CONFORMS WITH CONCEPT" or "CONFORMS AS NOTED (RESUBMISSION NOT REQUIRED)."
- B. Ordering of Materials: Order materials after receiving reviewed submittals from the Engineer marked "CONFORMS WITH CONCEPT" or "CONFORMS AS NOTED (RESUBMISSION NOT REQUIRED)." Order materials as required to ensure the receipt of materials in a timely fashion and permit the proper sequencing of the installation of materials for the proper flow of the Work.
- C. Review of submittals by the Engineer does not relieve the Contractor of her/his obligation to provide materials meeting the requirements of the Contract Documents. Features and options not identified or included in submittals, but specified in the Contract Documents, shall be provided with no additional compensation, whether or not such omission is noted by the Engineer. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the submittals, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of submittals.

1.07 SUBSTITUTIONS

- A. Comply with the general requirements of the Contract governing substitutions.
- B. Changes Due to Substitutions: The Contractor shall be responsible for all changes relating to substitutions requested by the Contractor, including changes required by other trades. The Contractor shall bear all costs arising from or otherwise relating to substituted items.

1.08 QUALITY ASSURANCE

- A. Provide new, first-class quality materials, delivered, erected, connected and finished in every detail, selected and arranged to fit properly into spaces indicated on the Drawings. Where no specific kind or quality of material is specified, provide first-class standard article.
- B. Furnish the services of one or more experienced superintendents, to be in charge of the installation of Work, and all skilled workmen, electricians and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

- C. Major items of electrical equipment and major components shall have the manufacturer's name, address and catalog or style number on a nameplate securely attached to the item of electrical equipment or component. Manufacturer nameplates shall be made of a durable, corrosion resistant material. As a minimum, manufacturer nameplates shall be provided for switchboards, panelboards, motor control centers, switchgear, automatic transfer switches, transformers, circuit breakers, disconnect switches and control panels.
- D. Single Source Responsibility: Switchboards, switchgear, panelboards, motor control centers, motor controllers, contactors, transformers, circuit breakers and disconnect switches shall be the standard products of a single manufacturer. Automatic transfer switches shall be the standard products of a single manufacturer. Each type cable and wire shall be the standard products of a single manufacturer. Fuses shall be the standard products of a single manufacturer.
- E. Equipment Manufacturer Qualifications: Equipment manufacturers shall have at least 10 years experience in manufacturing products similar to those proposed for use on this Project, with a documented record of successful in-service performance. Equipment manufacturers shall have in place at the time of the bid, at least one service facility within 100 miles of the Project Site capable of providing training, parts, and emergency maintenance and repairs.
- F. Review accessibility of equipment for operation, maintenance and repair prior to installation. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. Checkout: Upon completion of the Work, but prior to the punchlist inspection, the Contractor shall complete the following:
 - 1. General. Verify that all electrical materials are 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.
- H. 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, with their final settings.

1.09 COORDINATION AND SCHEDULING

- A. Coordination: Coordinate the installation of materials with the work of other trades. Prevent conflicts as to space requirements, dimensions, locations, code required working spaces, access openings, drawout and removal spaces or other matters tending to obstruct or delay the work of other trades. All changes caused by failure to coordinate shall be made by the Contractor at the Contractor's expense.
- B. Scheduling: Schedule (i.e. sequence, coordinate, and integrate) the installation of materials for efficient flow of the Work and as required to meet established project schedule milestones and deadlines.

1.10 CONSTRUCTION SITE SAFETY

- A. General: Comply with the general requirements of the contract governing construction site safety. Follow all AHJ and Owner specified mandates and procedures related to construction site safety. The Engineer has not been retained or compensated to provide design and construction review services relating to the Contractor's safety precautions or to the means, methods, techniques, sequences or procedures required for the Contractor to perform the Work. The Contractor will be solely and completely responsible for conditions of the Project Site, including the safety of all persons and property during performance of the Work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Engineer to conduct periodic construction progress observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the Project Site. It shall be the Contractor's responsibility to comply with applicable safety and health regulations for construction.

1.11 INSTALLATIONS

- A. General: The Drawings indicate the extent and the general location and arrangement of materials. The Contractor shall become familiar with all details of the Work and verify all dimensions in the field so that materials shall be properly located and readily accessible. The Contractor shall comply with the following:
 - 1. Verify all dimensions by field measurement.
 - 2. Install materials to conform with submittal data, marked "CONFORMS WITH CONCEPT" or "CONFORMS AS NOTED (RESUBMISSION NOT REQUIRED)," to the greatest extent possible. Conform to the arrangements indicated on the Drawings recognizing that portions of the Work are shown only in diagrammatic form.
 - 3. Any confusing, conflicting, or unclear information in the Specifications or on

the Drawings shall be referred to the Engineer prior to the bid for her/his resolution. Should the bidder consider that any requirements of the Specifications and/or Drawings will make the effective operation of any portion or whole installation impossible, she/he shall embody in her/his Proposal, stipulation for any change which she/he deems necessary. The failure to do so shall be considered an agreement on the part of the Bidder to guarantee the effective operation of said installation.

4. Install materials level and plumb, parallel and perpendicular to building lines and features.
 5. Install materials to facilitate servicing and maintenance, and repair or replacement of component parts. To the greatest extent possible, connect equipment for ease of disconnecting with a minimum of interference with other installations.
 6. Install materials as shown on the Drawings to the extent that the actual physical conditions of the site and the work of other trades will permit.
- B. Provide for the connection of electrical power and/or controls for all materials having electrical power and/or controls requirements.
1. Make electrical connections in accordance with manufacturer's written instructions, with recognized industry practices, and complying with requirements of the NEC.
 2. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit capacity, etc.) for equipment specified in other Divisions of this Specification by reviewing the submittals furnished for the equipment specified therein.
 3. Before commencing rough-in work, meet with each contractor furnishing equipment requiring electrical power and/or controls to review the electrical characteristics for each item of equipment. Immediately report discrepancies between the electrical characteristics noted during these meetings and the electrical characteristics noted on the Drawings to the Engineer for their resolution before proceeding with rough-in work.
- C. Cutting and Patching: Provide for and coordinate the locations of all openings required in the facility construction for the installation of the Work.
1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit the installation of the Work. Provide approved sleeves wherever penetrations through floors and walls are made. Where saw cutting or hole sawing of existing reinforced concrete floors is required, provide x-ray analysis of the floor in each area where a penetration is required to determine the exact locations of the encased reinforcement before commencing cutting or sawing operations. Do not cut, nick, graze or otherwise damage encased reinforcement. Unless otherwise indicated,

assume that all concrete floor slabs are reinforced. Fill openings and voids around conduits installed through sleeves, with a firestopping material of equal fire rating as the floor/wall penetrated. Perform cutting by skilled mechanics of trades involved.

2. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing material of equal fire rating as existing fireproofing material where existing fireproofing material has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

1.12 PROJECT FINALIZATION

- A. Cleaning: Upon completion of the Work, inspect the exposed finishes of materials installed as part of this Project. Remove burrs, dirt, paint spots and construction debris. Vacuum the interiors of all switchboards, switchgear, panelboards, motor control centers, switchgear, automatic transfer switches, transformers, circuit breakers, disconnect switches, cabinets and enclosures. Wipe clean the exteriors of all switchboards, switchgear, panelboards, motor control centers, switchgear, automatic transfer switches, transformers, circuit breakers, disconnect switches, cabinets and enclosures. In all cases, materials shall be cleaned in accordance with the manufacturer's published instructions.
- B. Testing, Adjusting and Demonstration:
 1. General: Test and adjust all materials installed as part of this Project. Demonstrate materials are complete, operational and fully functional in accordance with the requirements of the Contract Documents. Schedule the performance of field tests with the Owner and Engineer a minimum of 21 calendar days in advance of proposed tests dates. Unless otherwise notified in writing, field tests shall be performed in the presence of the Owner and Engineer.
 2. Field Tests Reports: Submit word processed reports of field tests in accordance with the general requirements of the Contract governing submittals. Reports shall include hard covers and dividers with suitable titles, table of contents and glossary of terms. Reports shall be printed on durable grade 60# white paper stock and bound. Reports shall specifically include the following:
 - a. Test procedures used.
 - b. Test results evaluated with respect to manufacturer specified criteria.
 - c. Results of failed tests and corrective actions taken to achieve test results that meet or exceed manufacturer specified criteria.

- C. Record Documents:
1. General: Submit record documents in accordance with the general requirements of the Contract.
 2. Record Drawings: The Contractor shall maintain at the site a clean undamaged set of black-line white prints of the Contract Drawings. This record set of 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.
- D. Facilitate Punchlist Inspection: The Contractor shall make one or more journeyman electricians available to accompany the Engineer during the punchlist inspection. The journeyman electrician(s) shall assist the Engineer 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 with a minimum of 21 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 will survey the completed installations for compliance with the requirements of the Contract Documents. Subsequent to the punchlist inspection, the Engineer 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.
- E. Operation and Maintenance Manuals:
1. General: Submit Operation and Maintenance manuals in accordance with the general requirements of the Contract governing submittals. Manuals shall include hard covers and dividers with suitable titles, table of contents and glossary of terms. Manuals shall be printed on durable grade 60# white paper stock and bound within sturdy D-ring binders of appropriate sizes. Where multiple binders are required to contain operation and maintenance data, all binders comprising Operation and Maintenance manuals shall be similar in appearance and organization. Manuals shall specifically include the following:
 - a. Copies of approved submittals.
 - b. Manufacturer published installation, setup, adjustment, operating and maintenance instructions and diagrams.
 - c. Manufacturer recommended maintenance schedules.
 - d. Schedules of device settings.
 - e. Lists of preventative maintenance parts/fluids with catalog numbers

- and name, address, phone numbers and contact persons of local vendor where parts/fluids are regularly stocked.
- f. Lists of replaceable/serviceable parts with catalog numbers and name, address, phone numbers and contact persons of local vendor where parts are regularly stocked.
 - g. Record drawings.
2. Deliverables: The Contractor shall deliver the quantity of copies of the final accepted Operations and Maintenance manuals as follows:
- a. Six (6) copies to the Owner upon Substantial Completion.
 - b. One copy to the Engineer.

PART 2 - PRODUCTS

<NOT USED>

PART 3 - EXECUTION

<NOT USED>

END OF SECTION

SECTION 16015
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

- A. A. This Section includes:
 - 1. Supporting devices for electrical components.
 - 2. Cutting and patching for electrical construction.
 - 3. Touchup painting.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and applicable provisions of Division 1 through 17 Specification Sections, apply to this Section as if specified herein.

PART 2 - PRODUCTS

2.01 SUPPORTING DEVICES

- A. Material: 316 stainless steel.
- B. Slotted-Steel Strut Supports for Slotted Channel Framing (Strut): 41-by-41 mm (1-5/8-by-1-5/8) cross section, formed from 2.7 mm (.01046-inch) thick steel, with 14-by-22 mm (9/16-by-7/8 inch) slots at a maximum of 50 mm (2 inches) o.c. in webs, and flange edges turned toward web. Fittings and accessories shall be products of the same manufacturer as strut and designed for use with that specific product.
- C. Raceway Supports: Manufactured riser clamps, straps, ceiling trapeze hangers, and wall brackets.
- D. Sleeves: Schedule 40 PVC conduit.
- E. Epoxy Set Anchors: Carbon-steel sleeve type.

2.02 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacture.

PART 3 - EXECUTION

3.01 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Selection of Supports: Comply with manufacturer's written instructions.
- B. Strength of Supports: Adequate to carry present and future loads, times a safety

factor of at least four; minimum of 90-kg (200-lb) design load.

3.02 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support materials.
- 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 strut and clamps.
- F. Install 6 mm (1/4-inch) diameter or larger threaded hanger rods, unless otherwise indicated.
- G. 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.
- H. Separately support cast boxes that are threaded to raceways. 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 610 mm (24 inches) from the box.
- I. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, cabinets and enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- J. Install sleeves for raceway penetrations of floors and walls unless core-drilled holes are used.
- K. Securely fasten materials to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Concrete: Epoxy set anchor bolts.
 - 2. Steel: Welded threaded studs.
 - 3. Field Welding: Comply with AWS D1.1.
 - 4. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
- L. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.03 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Supporting devices for electrical components.
 - 2. Touchup painting.

3.04 REFINISHING AND TOUCHUP PAINTING

- A. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
- C. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- D. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.05 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**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- 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.

PART 2 - PRODUCTS

2.01 GROUNDING CONDUCTORS

- A. Insulated Conductors: Comply with Specification Section 16123, "600 Volt or Less Wire and Cable."
- B. General: Comply with the following:
 - 1. Assembly of Stranded Conductors: ASTM B 8.
 - 2. Tinned Conductors: ASTM B 33.
- C. Material: Copper.
- D. Grounding Conductors: Bare, tinned, stranded.
- E. Counterpoise Ground Ring: Bare, tinned, stranded.
- F. Equipment Grounding Conductors: Insulated with green-colored insulation.
- G. Flexible Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

- H. Ground 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. Pressure Connectors: High-conductivity-plated units.
- C. Bolted Connectors: Heavy-duty, bolted-pressure-type.
- D. Welded Connectors:
 - 1. Exothermic-weld type, in kit form, selected and installed per manufacturer's published instructions.
 - 2. Approved for exposure or direct burial without degradation.
 - 3. Use graphite molds of proper size and design for the weld and connected items.
 - 4. Starting Weld material shall be copper oxide and aluminum mixture with a minimum 3 percent tin.
 - 5. Weld material shall be aluminum, copper and iron oxides ignited only by spark ignitor designed for the purpose.
 - 6. All welding material shall be of the same manufacturer.
 - 7. Provide tools and other devices required for a complete weld.

2.03 GROUNDING ELECTRODES

- A. Ground Rod: Solid copper clad steel, 19 mm (3/4-inch) diameter by 3048 mm (10-foot) long, copper clad steel sectional type with high strength steel core and electrolytic grade copper outer sheath, molten welded to the core with tapered point.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Conductors: Route conductors along the shortest and straightest paths possible using sweeping bends. Do not install conductors with sharp bends or kinks. Do not install conductors where they may be subject to strain, impact or damage. Do not install conductors where they cannot be readily accessed for visual inspection.
 - 1. Equipment Grounding Conductors:
 - a. General: Provide equipment grounding conductors in all feeder and branch circuit raceways, regardless of raceway type.
 - b. Connectors: Use bolted connectors.
 - 2. Bonding Straps/Jumpers: Install bonding straps/jumpers so vibration by

equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment.

- a. Use exothermic weld connections for outdoor locations.
 - b. Connect bond straps/jumpers directly to the basic structure taking care not to penetrate any adjacent parts.
 - c. Install bond straps/jumpers only in locations accessible for maintenance.
- B. Ground Rods: Make exothermic weld connections to ground rods without exposing steel or damaging copper coating.
- C. Connections:
1. General:
 - a. 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.
 - b. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - c. Make connections with clean, bare metal at points of contact.
 - d. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - e. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - f. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 2. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or welds that show convex surfaces indicating improper cleaning are not acceptable.
 3. Metal Raceway Terminations: Wherever metallic raceways terminate at metal cabinets, enclosures and housings, terminate each conduit with an insulated throat grounding bushing. Connect grounding bushings with a grounding conductor to ground bus or terminal within cabinet/enclosure/housing.
 4. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.
 5. 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 the grounding conductor.

3.02 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 and at each service entrance disconnect enclosure grounding terminal. 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 16075
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes identification materials and methods for electrical installations.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 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. Schedule:
 - 1. Lamicoid Plates: Submit a schedule of lamicoid plates scheduling the following information for plate:
 - a. Where plate is to be installed.
 - b. The number of lines of text.
 - c. The text for each line.
 - d. The text height for each line.
 - e. The overall dimensions of plate.
- C. Identification Scheme Descriptions:
 - 1. Control Wire/Cable: Submit a description of the Contractor developed alphanumeric identification scheme to uniquely identify each control wire and cable.

PART 2 - PRODUCTS

2.01 IDENTIFICATION MATERIALS

- A. Markers: Black felt-tip permanent ink type.
- B. Plain Colored Vinyl Marking Tape: Adhesive tape, 3-mil minimum by 25-mm (1-inch) wide minimum, in black, red, blue, brown, orange, yellow, white and green. Apply 12 mm (1/2-inch) minimum over-wrap through 50 mm (2-inch) minimum length.
- C. Preprinted Vinyl or Cloth Tape Labels: Self-adhesive tape labels with black letters

- on a white background, and manufacturer printed variety of individual numbers and letters.
- D. Machine Printed Vinyl Tape Labels: Self-adhesive custom machine printed single line legend label with black letters on a white field.
 - E. Machine Printed Vinyl Tape Labels with Clear Overwrap: Self-adhesive custom machine printed multi-line legend label with black letters on a white field and clear overwrap for protection of legend.
 - F. Lamicaid Plates: Custom engraved legend adhesive tape backed melamine plastic laminate flat stock plate, 1.75 mm (1/16-inch) minimum thickness for sizes up to 10000 square mm (16 square inches), and 3.5 mm (1/8-inch) minimum for sizes larger than 10000 square mm (16 square inches). Unless otherwise indicated, plate shall have black letters on a white field for nameplates and normal operating instructions, and white letters on a red field for critical operating instructions and warnings. Unless otherwise indicated, text shall be standard block style. Secure plate using adhesive backing and self-tapping stainless steel screws.
 - G. Underground Duct Line Marking Tape: Metallic foil backed marking tape with pre-printed warning message identifying type of system. Material shall be compounded for unlimited life when direct buried; 150 mm (6-inch) minimum width by 4-mils thick.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Markers: Use to identify point of origin, utilization equipment and circuits contain within raceways and boxes in unfinished spaces.
- B. Plain Colored Vinyl Marking Tape: Use to identify voltage and phase of power wires. Provide a minimum 100 mm (4-inch) wide band of plain colored vinyl marking tape on black insulated feeder wires at every splice and termination, and within every pull and junction box. Apply plain colored vinyl marking tape with a minimum 50 percent overlap. Refer to Specification Section 16123, "600V or Less Wire and Cable" for color coding scheme.
- C. Preprinted Vinyl or Cloth Tape Labels: Use to identify circuit point of origin and circuit numbers of power wires. Minimum text height shall be 3 mm (1/8-inch).
- D. Machine Printed Vinyl Tape Labels: Use to identify circuit point of origin and circuit numbers of receptacles, and telephone and communications outlets in accordance with the approved telephone and communications systems outlets alphanumeric identification scheme. Minimum text height shall be 3 mm (1/8-inch).
- E. Machine Printed Vinyl Tape Labels with Clear Overwrap: Use to identify control wires and cables in accordance with the established control system wire and cable alphanumeric identification scheme. Minimum text height shall be 2 mm (1/16-inch).

- F. Lamicoid Plates: Use to identify panelboards, motor controllers, switchgear, transformers, circuit breakers, disconnect switches and control panels. Minimum text height shall be as follows:
1. 25 mm (1-inch) for unit designation identification plates.
 2. 12 mm (1/2-inch) for subcomponent designation identification plates.
 3. 12 mm (1/2-inch) for warning plates.
 4. 12 mm (1/2-inch) for operating instructions plates installed above 1.68 m (66-inches) above finished floor.
 5. 6 mm (1/4-inch) for operating instructions plates installed at 1.68 m (66-inches) above finished floor or lower.
- G. Underground Duct Line Marking Tape: Use for identifying the routing of underground duct lines.

3.02 INSTALLATION

- A. Install identification materials of types, where indicated and as required by the AHJ.
- B. Install identification materials in accordance with the manufacturer's published installation.
- C. Locate identification materials for optimum viewing and without interference with the operation and maintenance of equipment.
- D. Coordinate names, abbreviations, colors, graphics and other designations used for electrical identification with corresponding designations used in the Contract Documents or as required by codes and standards. Use consistent designations throughout the Project. Do not abbreviate label elements without the prior written approval of the Engineer.
- E. Where identification material is to be applied to surfaces specified to receive finish coatings and/or surface treatments, install identification material after finish coatings/surface treatments installation work is complete.
- F. Coordinate installing identification materials prior to installing acoustical ceilings and similar finishes that conceal such items.
- G. Clean surfaces of dust, loose material, and oily films before applying marker, paint or adhesive identification materials.

END OF SECTION



SECTION 16123
600 VOLT OR LESS WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes requirements for insulated conductor wire and cable, and associated connectors for general power and control use at voltages 600 volts or less, for sizes #14 AWG through 750 kcmil.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 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.

PART 2 - PRODUCTS

2.01 WIRE AND CABLE

- A. Provide wire type as specified in Part 3 Para. 3.02, "Wire and Cable Application."
- B. THHN/THWN-2: UL Standard 83. Wires shall be UL-listed Type THHN/THWN-2 suitable for use in dry or wet locations, operation at 600 volt, and at temperatures not to exceed 90 degrees C (194 degrees F). Conductor sizes #2 AWG and larger with black color insulation shall be marked sunlight resistant. Conductor sizes 1/0 AWG and larger shall be listed for CT use. Conductors shall be stranded annealed copper, insulated with abrasion, moisture and heat resistant thermoplastic insulation and nylon outer jacket.

2.02 CONNECTORS AND SPLICES

- A. General:
 - 1. UL listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated.
 - 2. For #14 through #10 AWG wire sizes, provide insulated spring wire connectors or insulated compression connectors.

3. For #8 AWG wire, use pressure connectors with insulating sleeves.
4. For #6 AWG and larger wire, use compression connectors and compression dies designed for the exact connector being used. Provide insulating sleeves manufactured specifically for the connector being used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine raceways to receive wire and cable for compliance with requirements for installation tolerances and other conditions, which could affect the performance of wire. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRE AND CABLE APPLICATION

- A. Dry and Wet Indoor and Outdoor Locations: Use THHN/THWN-2 wire.

3.03 INSTALLATION

- A. Install wire and cable as indicated in accordance with the manufacturer's published installation instructions.
- B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary. Compound used must not deteriorate conductors or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceways.
- D. For parallel conductors of a single phase, insure that conductor lengths are equal by actual length comparison before installation.
- E. Minimum conductor size for power feeders/branch circuits shall be #12 AWG, and for control circuits #14 AWG.
- F. Except where specifically noted otherwise, wire splices are **not** allowed.
- G. 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. For bolted connections in equipment, mark lugs after torquing with red paint such that paint will be visibly disturbed if lugs are disturbed.

- H. Wiring at Outlets: Install conductors at each outlet, with at least 300 mm (12-inches) of slack.
- I. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- J. Identify wires and cables in accordance with Specification Section 16075, "Electrical Identification." Feeder, branch circuit, and control conductors #10 AWG and smaller shall have color coded insulation. Feeder conductors #8 AWG and larger shall have black color insulation marked with plain colored vinyl marking tape. Apply the following color code:
1. 480Y/277-Volt, 3-phase, 4-wire systems:

Phase A	Brown
Phase B	Orange
Phase C	Yellow
Neutral	Gray
Ground	Green
 2. 208Y/120-Volt, 3-phase, 4-wire systems:

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green
 3. 120/240-Volt, 1-phase, 4-wire systems:

Phase A	Black
Phase B	Red
Neutral	White
Ground	Green
 4. Control System Color Coding:

120 VAC Control	Red
120 VAC Control Neutral	White

DC Control (+)	Blue
DC Control (-)	Blue/White
Ground	Green

3.04 FIELD TESTS

- A. Power Wire Tests: Test each feeder and branch circuit wire before it is placed in service.
 - 1. Insulation Tests: Megger test for a minimum of 30 seconds each, all 600 volt insulated wire #2 AWG and larger using a 500 volt megger for 208 and 240 volt systems, and a 1000 volt megger for 480 volt systems. Test between phase conductors and from each conductor to ground before energizing. Perform insulation tests with wire/cable disconnected at both ends. Megger wire and cable only after installation, not on the cable reel.
 - 2. Ground Fault Tests: Using a volt/ohm meter, test all conductors #2 AWG and smaller for possible continuity to ground.
 - 3. Phasing Tests: Test phasing of all wires serving motors for proper phase rotation. Test phasing of all conductors that are to be connected in parallel. Make all changes necessary to ensure proper phase sequencing.
 - 4. Correct deficiencies and retest to demonstrate compliance with specified criteria.

- B. Control Wire and Cables Tests: Test each control wire before it is placed into service.
 - 1. Terminal Tightness Tests: Verify tightness of terminal contacts for each control wire terminal.
 - 2. Continuity Tests: Check each control wire for continuity (especially current transformer leads). Verify control wire continuity by means of battery-powered lights, buzzers, bells, or telephones.
 - 3. Correct deficiencies and retest to demonstrate compliance with specified criteria.

- C. Tagging of Tested Wires: Upon completion of specified tests where results demonstrate compliance with specified criteria, attach a temporary cardboard tag to the wire that identifies the tests performed, the name(s) of the person(s) who performed the tests, the date the tests were performed, and the results of the tests. These tags shall be removed by the Contractor in the presence of the Owner prior to energizing wires or otherwise placing wires into service.

- D. Field Tests Report: Prepare and submit Field Tests Report in accordance with the requirements of Specification Section 16010, "Basic Electrical Requirements." Field Tests Report shall include a description of the test procedure for each different type of test performed and a schedule of wires that includes the following information for each wire:
1. Schedule entry number.
 2. Description of the wire including origination, load served, and segment of circuit (as applicable).
 3. Tests performed.
 4. Test results indicating compliance with specified criteria.
 5. Corrective actions taken to achieve compliance with specified criteria.

END OF SECTION

**SECTION 16130
RACEWAYS**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes raceways and fittings for electrical installations.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 Specification Sections, apply to the Work of this Section as if specified herein.

1.02 ABBREVIATIONS

- A. LFNC: Liquidtight flexible non-metallic conduit.
- B. PVC: Polyvinyl chloride.
- C. RGS: Rigid galvanized steel.
- D. RMC: Rigid metal conduit.
- E. RNC: Rigid non-metallic conduit.

1.03 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.

PART 2 - PRODUCTS

2.01 RMC

- A. Conduit: ANSI C80.1; RGS heavy-wall threaded conduit, 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. Couplings: Couplings shall be threaded, hot dip or electro-galvanized steel with chromate coating and made by the same manufacturer as the conduit.
- C. Fittings: NEMA FB 1; compatible with conduit materials, and listed and labeled by the manufacturer as suitable for use in the environment where installed.

2.02 RNC

- A. Conduit: NEMA TC-2 and UL 651; PVC Schedule 40 and 80.
- B. Fittings: NEMA TC-3 and UL 514B; listed and marked for indoor and outdoor use, of the same manufacturer as the RNC, and listed by the RNC manufacturer

for use with the specific type of conduit to which the fitting is to be applied.

- C. Cement for connections of conduit and fittings shall be approved by the manufacturer of the conduit.

2.03 LFNC

- A. Conduit: UL 1660; Type B (LFNC-B), PVC, listed and marked as suitable for use indoors and outdoors.
- B. Fittings: NEMA TC-3 and UL 514B; PVC, listed and marked for indoor and outdoor use, of the same manufacturer as the LFNC, and listed by the LFNC manufacturer for use with the specific type of conduit to which the fitting is to be applied.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive raceways for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRING METHODS

- A. General: Use the following wiring methods unless otherwise noted herein or on the Contract Drawings:
 - 1. Exposed and Concealed: Use Schedule 80 PVC conduit.
 - 2. Underground (Direct Buried): Use Schedule 80 PVC conduit.
 - 3. Underground (As Part of a Rebar Reinforced Concrete Encased Duct Bank): Use Schedule 40 PVC conduit.
 - 4. RGS Conduit: Use only where specifically noted herein or on the Contract Drawings.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Use LFNC.
- B. General Requirements:
 - 1. Raceways are shown on the Contract Drawings in approximate locations unless dimensioned. Locate raceways where shown on the Contract Drawings and at other locations where required for wire pulling, equipment connections, and to comply with governing standards and codes. Coordinate layout and installation of raceways with other construction elements to ensure adequate headroom, working clearances, and access. 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 complete, proper,

- operational, and fully functional installation.
2. Install conduit in accordance with NECA “Standard of Installation” and manufacturer’s published installation instructions. Use raceway fittings compatible with raceways and suitable for the intended use.
 3. Minimum Conduit Size: 19mm (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. Provide temporary closures to prevent foreign matter from entering raceways.
 7. Cut conduit square using a band saw or pipe cutter, and ream thoroughly to remove burrs.
 8. Use hydraulic one-shot conduit bender or factory elbows for conduit 50mm (2-inch) and larger.
 9. Route conduit under slabs on grade from point-to-point or shortest practical path.
 10. Arrange conduit supports to prevent misalignment during wiring installation.
 11. Support individual conduit using strut and conduit straps, malleable two hole conduit straps, or threaded rods with conduit fasteners and split hangers.
 12. Group related conduits on common racks or trapeze. Construct racks or trapeze using strut and conduit straps; provide space on each for 25 percent additional conduits. Construct trapeze using strut, threaded rods, and conduit straps; provide space on each for 25 percent additional conduits. Each conduit shall be independently secured to the rack or trapeze.
 13. Do not support conduit with the tie wire or perforated pipe straps. Remove wire used for temporary supports.
 14. Conduit shall be installed a minimum of 305mm (12-inches) from steam or hot water piping, flues or any other surface with a surface temperature exceeding 40° C (104° F) run in parallel with the conduit, and a minimum of 152mm (6-inches) where run perpendicular to the conduit. Conduit shall be installed a minimum of 76mm (3-inches) from cold or chilled water piping.
 15. Bring conduit to shoulder of fittings; fasten wrench-tight.
 16. When threads are cut in RMC in the field, the conduit and fittings shall be

- made up immediately. If there are any threads showing, they shall be coated with a corrosion resistant compound approved by the conduit manufacturer.
17. Solvent weld RNC 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.
 18. Use conduit hubs or watertight fittings to fasten conduit to boxes.
 19. In general, install no more than equivalent of three 90-degree bends between pull or outlet boxes. For communication conduits, install no more than equivalent of two 90-degree 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 50mm (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.
 20. Avoid moisture traps; provide junction box with drain fitting at low point in conduit system.
 21. Provide approved adapters when RNC is coupled to RMC.
 22. Where RNC is used underground, a PVC coated RMC elbow shall be provided at the point where the conduit turns up. The vertical portion of the riser shall be PVC coated RMC to a point 915mm (18-inches) minimum above grade or floor slab.
 23. 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.
 24. Provide raceway sealing where indicated on Contract Drawings and/or where required by the NEC and/or where required by the AHJ. Install raceway sealing fittings in accordance with the manufacturer's published installation instructions. Locate fittings at suitable, approved, and accessible locations and fill them with manufacturer recommended UL-listed sealing compound. 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. 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.
 25. Install a pull rope in each empty conduit. Pull rope shall be monofilament

- plastic having a minimum 90.7kg (200-lbs) tensile strength. Leave a minimum of 305mm (12-inches) of slack at each end of the pull line and securely fasten pull rope to conduit.
26. Where conduits rise through floor slabs, curved portions or bends shall not be visible above the finished slab.
 27. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms.
 28. 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.
 29. 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.
 30. Ground and bond conduit under provisions of Section 16060 - Grounding.
 31. Identify conduit under provisions of Section 16075 - Electrical Identification.
 32. 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 RMC, flush with finished concrete surfaces. Sleeves for all conduits passing through the floor shall be galvanized NPS pipe or RMC extending 50mm (2-inches) above finished floor, and flush with slab below.
 33. Install conduit to preserve fire and smoke resistance rating of partitions and floors.
 34. Provide insulating bushings on all feeder conduits.
 35. Provide code size pull boxes, in accessible locations, in all conduits where the number and degree of bends exceed the code limitations.
 36. Provide threaded, watertight cap on the ends of conduits stubbed out below grade.
 37. Exposed suspended conduits shall be located as to provide proper headroom as required by OSHA regulations.
 38. Conduit runs shall be complete before wires are installed in them.
 39. 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.

40. 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 RMC; LFNC may be used 150mm (6-inches) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
41. Flexible Connections: Use maximum of 1829mm (72-inches) of LFNC for equipment subject to vibration, noise transmission, or movement; and for all motors. Provide each flexible connection with at least one union fitting to facilitate disconnection and remove.
42. Give right of way to raceways and piping systems required to be installed at a specific slope.
43. Keep electrical conduits free from contact with other dissimilar metals.
44. Provide combination deflection/expansion fittings, including bonding jumper, where raceway system crosses building seismic, control or expansion joints.
45. Avoid moisture traps. Provide junction box with drain fitting at low points in conduit system.

3.03 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 610mm (24-inch) MINIMUM depth or as required by the NEC if more than 610mm (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 200mm (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 150mm (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 305mm (12-inches), strips shall be placed parallel, on 305mm (12-inches) centers, centered directly above the conduit bank. Refer to Section

16075 – Electrical Identification.

3.04 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.

3.05 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. This Section includes boxes for electrical installations.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 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.

PART 2 - PRODUCTS

2.01 OUTLET BOXES

- A. Weatherproof Outlet Boxes: Provide PVC weatherproof outlet wiring boxes, of types, shapes and sizes, including depths of boxes, with conduit hubs, covers with spring-hinged waterproof caps suitably configured for each application, including cover gaskets and stainless steel fasteners.
- B. Conduit Bodies: Provide 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. Provide PVC where connected to PVC conduit and galvanized cast-metal where connected to RMC.
- C. 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.
- D. At each outlet shown, provide a box of suitable size and construction to serve the purpose properly.

2.02 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA 4X 316 stainless steel with screw attached cover and 316 stainless steel screws, unless otherwise noted on drawings.
- B. Hinged Cover Enclosures: NEMA 4X 316 stainless steel with continuous hinge cover and 316 stainless steel hinge pin, 316 stainless steel back panel, tee handle latch mechanism, and 316 stainless steel pad lock hasp and hardware, unless

otherwise noted on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES

- A. 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.
- B. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
- C. Provide weatherproof outlets for interior and exterior locations.
- D. Provide closures to cap unused hubs.
- E. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.
- F. 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.
- G. 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.
- H. 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.
- I. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- J. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- K. Install boxes to preserve fire resistance rating of partitions and other elements.
- L. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices.
- M. 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.
- N. Use gang box where more than one device is mounted together. Do not use sectional box.
- O. 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.

- P. 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.
- Q. 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. Coordinate mounting heights or outlet boxes with the device mounting heights indicated on the Drawings.
- D. Orient boxes to accommodate wiring device orientation.
- E. Align adjacent wall mounted boxes for switches, thermostats and similar devices.
- F. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- G. Position outlet boxes to locate light fixtures as shown on reflected ceiling plan.
- H. Coordinate with architectural, structural and mechanical so that boxes will be accessible.

3.03 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 switches, receptacles, device plates and box covers, and photocell switches.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 Specification Sections, apply to the Work of this Section as if specified herein.

1.02 ABBREVIATIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. TVSS: Transient voltage surge suppressor.

1.03 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.

PART 2 - PRODUCTS

2.01 WALL SWITCHES

- A. Description: UL 20, Industrial 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, Industrial 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, Industrial 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 COVER PLATES

- A. Weatherproof Cover Plate: Gasketed PVC 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 PHOTOCCELL 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 2000 watts (1800 watts for tungsten loads) 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. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- E. Install cover plates on receptacle, switch, and blank outlets.

- F. Connect wiring devices by wrapping conductor around screw terminal.
- G. Arrangement of Devices: Mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.
- H. Protect devices and assemblies during painting.
- I. Install cover plates when painting is complete.

3.02 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 manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A.

3.03 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.

3.04 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

SECTION 16410
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes 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: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 Specification Sections, apply to the Work of this Section as if specified herein.

1.02 ABBREVIATIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.03 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.

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 and fuse ampere rating shall be as indicated.
- D. Fuses: UL Class RK5 unless otherwise indicated.
- E. Enclosures:

2.02 ENCLOSED CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: UL 489, NEMA AB 1, with interrupting capacity to meet available fault currents. 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.
- 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 conductor material.

2.03 ENCLOSURES

- A. NEMA KS 1 (Enclosed Switches) and NEMA AB 1 (Enclosed Circuit Breakers), NEMA Type 4X, 316 stainless steel (brushed finish), surface mounted.

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. 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. Enclosure Nameplates: Identify each enclosed switch and circuit breaker by attaching a laminated plastic nameplate cover, 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 enclosed switches and circuit breakers with ground continuity to main grounding 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.

3.05 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 16416
TRANSIENT VOLTAGE SURGE SUPPRESSOR

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes transient voltage surge suppressor (TVSS) units.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 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.

PART 2 - PRODUCTS

2.01 SURGE SUPPRESSOR

- A. TVSS shall be Listed and Component Recognized in accordance with UL 1449 2nd Edition and UL 1283.
- B. TVSS shall be UL 1449 2nd Edition listed with 200kA Short Circuit Current Rating (SCCR) in compliance with NEC 285.6.
- C. TVSS shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G in WYE systems, and L-L, L-G in DELTA systems.
- D. TVSS for service entrance applications shall be modular in design. Each mode including N-G shall be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device.
- E. Service entrance TVSS shall provide audible diagnostic monitoring by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided.
- F. TVSS shall meet or exceed the following criteria:
 - 1. Minimum surge current capability (single pulse rated) per phase shall be: 240kA per phase.
 - 2. UL 1449 Listed Suppression Voltage Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>MCO</u>
480Y/277V	700V	700V	700V	$\frac{V}{320V}$

- G. TVSS shall have a minimum EMI/RFI filtering of -50dB at 100kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.
- H. TVSS shall be provided with one set of NO/NC dry contacts.
- I. TVSS shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

2.02 MANUFACTURERS

- A. Approved Vendors: Siemens TPS12240 Series.

PART 3 - EXECUTION

3.01 TVSS

- A. Install TVSS units in accordance with manufacturer's written instructions.
- B. The TVSS ground shall be bonded to the service entrance ground.

END OF SECTION

**SECTION 16442
PANELBOARDS**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes panelboards.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 Specification Sections, apply to the Work of this Section as if specified herein.

1.02 ABBREVIATIONS

- 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.

1.03 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.

PART 2 - PRODUCTS

2.01 PANELBOARDS

- 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. Eaton Corp.; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Div.
 - 3. Square D Co.
- B. Enclosures: NEMA Type 4X 316 stainless steel, surface mounted cabinets.

- C. Dead-Front Panel: 316 stainless steel.
- D. Finish: Brushed.
- 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 listed and labeled as suitable for use as service equipment for each panelboard with a main circuit breaker intended to serve as service equipment.
- J. Fully rated to interrupt symmetrical short-circuit current indicated on the Drawings.
- K. Circuit Breakers:
 - 1. UL 489, NEMA AB 1, molded-case type, with interrupting capacity to meet available fault currents. 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. Main: Separately mounted at top of panelboard where top fed, or at bottom of panelboard where bottom fed, bolt-on type.
 - 3. Branch: Bolt-on type, replaceable without disturbing adjacent units.
- L. Features and Accessories: As indicated on Drawings.

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.
- 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 self-tapping stainless steel 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 ADJUSTING

- A. Set field-adjustable circuit-breaker trip ranges.

3.05 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 16444
MOTOR CONTROLLERS**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes motor controllers.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 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.

PART 2 - PRODUCTS

2.01 GENERAL

- 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. Eaton Corp.; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Div.
 - 3. Square D Co.
- B. Coordination: Coordinate features, accessories, and functions of each enclosed controller and each accessory device with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load. Coordinate features of each enclosed controller and each accessory device with pilot devices and control circuits to which they connect.
- C. Enclosures: NEMA Type 4X, 316 stainless steel, brushed finish.

2.02 MANUAL ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

2.03 MAGNETIC ENCLOSED CONTROLLERS

- A. General: Factory-assembled combination controller with integral overcurrent protective device disconnecting means and magnetic motor starter unit. Select controller features to coordinate with ratings and characteristics of supply circuit and the actual motor to be controlled; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Motor Starter Units: FVNR (Full Voltage Non-Reversing), NEMA ICS 2, Class A, across the line.
- C. Overcurrent Protective Device Disconnecting Means: Molded-case circuit breaker, UL 489 9, MCP (motor circuit protector) type with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- D. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10/20 (field selectable) tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
- E. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
- F. Accessories: Devices shall be factory installed in controller enclosure, unless otherwise indicated.
 - 1. Pilot Relay(s): 20A, 120V rated DPDT contacts, plug-in type industrial control relay with coil voltage rating as required and mating modular socket. Pilot relays are to be wired into motor control circuits so as to interface external control power sources with the controller control power transformer as shown on the Drawings.
 - 2. Pushbuttons , Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type. Pilot lights shall be LED type, suitable for operation on 120V ac, in colors as indicated on Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive enclosed controllers for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install enclosed controllers in accordance with the manufacturer's published installation instructions.
- B. Install enclosed controllers plumb and secure. Provide for mounting and anchoring of enclosed controllers in accordance with the requirements of Specification Section 16015, "Basic Electrical Materials and Methods." For wall mount enclosed controllers, mount on structural steel channels bolted to wall.
- C. Provide for installation of control circuit devices and wiring as shown on the Drawings. Bundle, train, and support feeder and branch circuit and control circuit wiring in enclosed controllers.
- D. 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.
- E. Test installed enclosed controllers in accordance with the paragraph, "Field Tests" below.

3.03 FIELD TESTS

- A. Perform tests only after installed line- and load-side feeder/branch circuits and control circuits have been installed, tested and found to be in compliance with specified criteria.
- B. After enclosed controller is installed, but prior to energizing line- and load-side feeder/branch circuits and control circuits, test the enclosed controller insulation resistance. Perform insulation resistance tests on enclosed controller in accordance with the manufacturer's recommendations. Compare measured insulation resistance values with the minimum insulation resistance values specified by enclosed controller manufacturer. Tested enclosed controllers in which the measured insulation resistance value does not meet or exceed the minimum insulation resistance value specified by the manufacturer, shall be replaced in kind with new and retested.
- C. After enclosed controller is installed, is found to be in compliance with manufacturer specified insulation resistance criteria, and line- and load-side feeder/branch circuits and control circuits are energized, perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5, 7.6, and 7.16. Certify compliance with test parameters. Correct malfunctioning enclosed controllers on-site, where possible, and retest to demonstrate compliance with specified criteria; otherwise, replace in kind with new and retest.
- D. Prepare and submit Field Tests Report in accordance Specification Section 16010, "Basic Electrical Requirements." Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.04 ADJUSTING

- A. Set field-adjustable circuit-breaker trip characteristics.

3.05 CLEANING

- A. Clean interior of motor controller enclosures to remove dust, debris and other material.
- B. Clean exposed surfaces and restore finish where scratched or marred.

END OF SECTION

SECTION 16461
DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes dry-type transformers.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 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.

PART 2 - PRODUCTS

2.01 GENERAL

- 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. 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. Comply with NEMA ST 20 and listed and labeled as complying with UL 1561.
- C. Factory Tests: Transformers shall be subjected to routine factory tests as required to demonstrate compliance with referenced standards.
- D. Description: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
- E. Cores and Coils:

1. General: Epoxy-resin encapsulated core and coil.
 2. Core Material: Grain-oriented, nonaging silicon steel.
 3. Coils: Copper. Continuous windings without splices, except for taps. One leg per phase.
 4. Internal Coil Connections: Brazed or pressure type.
- F. Windings: One coil per phase in primary and secondary.
- G. Enclosure: NEMA Type 3R 316 stainless steel.
- H. Insulation Class: 185 degrees C class.
- I. Rated Temperature Rise: 115 degrees C maximum rise for 185 degrees C class insulation.
- J. 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.
- K. Fungus Proofing: Permanent fungicidal treatment for coil and core.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive dry-type transformers for compliance with requirements, 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 enclosed dry-type transformers level and secure. Provide for mounting and anchoring of dry-type transformers in accordance with Specification Section 16015, "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. 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.

3.05 CLEANING

- A. Clean interior of dry-type transformer enclosures to remove dust, debris and other material.
- B. Clean exposed surfaces and restore finish where scratched or marred.

END OF SECTION

**SECTION 16511
LIGHTING**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes interior and exterior lighting fixtures, lamps, ballasts, and accessories.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 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 and the following:
 - 1. Manufacturer/Factory Authorized Representative/Vendor List: Prepare and submit with lighting fixture submittals, a list identifying the lighting fixture manufacturer, factory authorized representative and vendor for each type lighting fixture proposed for use on this Project. Provide names, addresses, and telephone numbers for each lighting fixture manufacturer, factory authorized representative, and vendor. Lighting fixture submittals without this information will be rejected and returned to the Contractor without review, and resubmittal for lighting fixtures will be required

PART 2 - PRODUCTS

2.01 LIGHTING FIXTURES

- A. General: Refer to lighting fixture schedule on Drawings for lighting fixture specification.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for exterior lighting fixtures, and UL 1598.
- C. Metal Parts: Free from burrs, sharp corners, and edges.
- D. Sheet Metal Components: Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide combination filter and breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage

under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens.

- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- I. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminating Silver Metalized Film: 90 percent.
- J. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens in luminaire doors.
- K. Mounting Hardware and Trim: Coordinate layout and installation of lighting fixtures with structure construction and provide all accessory mounting hardware and trim necessary to interface with same regardless of whether or not such mounting hardware and trim are specifically identified on the Drawings as being required.

2. 02 HIGH-INTENSITY-DISCHARGE LAMP BALLAST

- A. General: Comply with ANSI C82.4 and UL 1029.
- B. Type: Lead Type Auto-Reg (Auto-Regulator), unless otherwise indicated.
- C. Operating Voltage: Match system voltage.
- D. Minimum Starting Temperature: Minus 30 degrees C (minus 22 degrees F) for single lamp ballasts.
- E. Normal Ambient Operating Temperature: 40 degrees C (104 degrees F).
- F. Tolerance to Abnormal or Lamp End-of-Life Operating Conditions: Ballast system (core and coil, ignitor and capacitor) shall be capable of operating for a minimum of 6 months under lamp open- or short-circuit or end-of-life cycling failure conditions.
- G. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.
- H. Noise: Uniformly quiet operation, with a noise rating of B or better.
- I. Ballast Fuses: One in each ungrounded supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

2.03 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive County of other rights County may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, signed by manufacturer and Installer agreeing to replace external parts of luminaires and poles exhibiting a failure of finish as follows:
Protection of Metal from Corrosion:
 - 1. Warranty against perforation or erosion of finish due to weathering.
 - 2. Color Retention: Warranty against fading, staining, and chalking due to effects of weather and solar radiation.

This special warranty is in addition to, and not a limitation of, other rights and remedies Owner may have under requirements of the Contract Documents.
- C. Warranty Period: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to lighting fixtures for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Set surface mounted lighting fixtures level, plumb, and square with ceiling and walls, and secure in accordance with the manufacturer's published installation instructions and approved submittal materials. Provide for mounting and anchoring of interior lighting fixtures and accessory components in accordance with Specification Section 16015, "Basic Electrical Materials and Methods."
- B. Concrete Foundations: Construct concrete foundations in accordance with the general requirements of the Contract governing the construction of poured in place concrete structures. Refer to pole foundation details on Drawings.
- C. Verify anchor-bolt templates by comparing with actual pole bases furnished.
- D. Install poles as follows:
 - 1. Use web fabric slings (not chain or cable) to raise and set poles.
 - 2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

3. Secure poles level, plumb, and square.
 4. Grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space.
 5. Use a short piece of 13 mm (1/2-inch) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Luminaire Attachment: Fasten to indicated structural supports, plumb and level.
 - F. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow aiming to provide required illumination as directed by the Engineer.
 - G. Lamp luminaires with indicated lamps in accordance with the manufacturer's published installation instructions. Replace malfunctioning lamps in kind with new.
 - H. Connect branch circuit equipment grounding conductor to lighting fixture ground lug.
 - I. 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.
 - J. Test installed lighting fixtures in accordance with the paragraph, "Field Tests" below.

3.03 FIELD TESTS

- A. Perform tests only after lighting circuits have been installed, tested and found to be in compliance with specified criteria.
- B. After lighting fixture is installed and lighting circuit is energized, verify normal operation. Correct malfunctioning lighting fixtures on-site, where possible, and retest to demonstrate proper operation; otherwise, replace in kind with new and retest.
- C. After emergency lighting unit is installed and lighting circuit is energized, verify normal operation. De-energize and energize lighting circuit to observe transfer to battery source and retransfer to normal power source. Correct malfunctioning emergency lighting units on-site, where possible, and retest to demonstrate proper operation; otherwise, replace in kind with new and retest.
- D. After exit sign is installed and lighting circuit is energized, verify normal operation. De-energize and energize lighting circuit to observe transfer to battery source and retransfer to normal power source. Correct malfunctioning exit sign on-site, where possible, and retest to demonstrate proper operation; otherwise, replace in kind with new and retest.
- E. Replace lighting fixtures that exhibit signs of corrosion within the specified warranty period, in kind with new.

3.04 ADJUSTING

- A. Adjust aimable fixtures to provide required light intensities and as directed by the Engineer.

3.05 CLEANING

- A. Clean exposed surfaces and restore finish where scratched or marred.

END OF SECTION

SECTION 16800
LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the requirements for the installation of lightning protection on above ground structures.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 Specification Sections, apply to the Work of this Section as if specified herein.

1.02 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is NRTL listed or who is certified by LPI as a Master Installer/Designer.
- B. Provide UL Master Label.
- C. Provide LPI certification of system.

1.03 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. Shop Drawings: Detail lightning protection system, including materials (type and construction), air-terminal locations, conductor routing and connections, and bonding and grounding provisions.
- C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by nationally recognized testing laboratory (NRTL) or trade association.
- D. Field inspection reports indicating compliance with specified requirements.

1.04 COORDINATION

- A. Coordinate installation of lightning protection materials with the installation of other systems and components, including electrical wiring, supporting structures and materials, metal bodies requiring bonding to lightning protection components, and finishes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: The following manufacturers may be capable of supplying acceptable products:
 - 1. Harger Lightning Protection, Inc.
 - 2. Heary Bros. Lightning Protection Co. Inc.
 - 3. Independent Protection Company, Inc.
 - 4. Robbins Lightning, Incorporated.
- B. Thompson Lightning Protection, Inc.

2.02 LIGHTNING PROTECTION SYSTEM COMPONENTS

- A. Comply with UL 96.
- B. Air Terminals: NFPA 780 Class I:
 - 1. Solid copper, ½” diameter by 24” long, with safety tip for use with copper compatible air terminal base and copper conductor.
 - 2. Solid aluminum, ½” diameter by 24” long, with safety tip for use with aluminum compatible air terminal base and aluminum conductor.
- C. Air Terminal Bases:
 - 1. Adhesive Type: Adhesive mounted with integral threaded stud for air terminal and integral mechanical conductor connection, and suitable for use with air terminal and conductor materials. Stamped copper or cast bronze where in contact with structure concrete or steel elements. Aluminum where in contact with structure aluminum elements. Adhesive shall be as recommended by the lighting protection system vendor and approved by the Contractor erecting the structure.
 - 2. Bolt Mounted: Rigidly bolted to structure with integral threaded stud for air terminal and integral mechanical conductor connection, and suitable for use with air terminal and conductor materials. Cast bronze where in contact with structure concrete or steel elements. Aluminum where in contact with structure aluminum elements.
 - 3. Clamp Mounted: Rigidly clamped to structure with integral threaded stud for air terminal and integral mechanical conductor connection, and suitable for use with air terminal and conductor materials. Cast bronze where in contact with structure steel elements. Aluminum where in contact with structure aluminum elements.
- D. Lighting Protection System Main, Secondary, and Down Conductors: NFPA 780 Class I. Stranded aluminum except where specifically identified on Drawings to be

stranded copper.

- E. Supporting Devices:
 - 1. Bolt Mounted: Rigidly bolted to structure with integral mechanical conductor connection, and suitable for use with conductor material. Copper or cast bronze where in contact with structure steel elements. Aluminum where in contact with structure aluminum elements.
 - 2. Clamp Mounted: Rigidly clamped to structure with integral mechanical conductor connection, and suitable for use with conductor material. Copper where in contact with structure steel elements. Aluminum where in contact with structure aluminum elements.
- F. Ground Rods and Counterpoise Ground Ring Conductors: Comply with Specification Section 16060 "Grounding" and standards referenced in this Section.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install lightning protection components and systems according to UL 96A, LPI-175 and NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.
- C. Cable Connections: Use approved exothermic-welded connections for all below grade conductor splices and connections between conductors and other components.
- D. The counterpoise ground ring conductor installation, based on requirements in Specification Section 16060 "Grounding," shall be used as a ground loop required by NFPA 780. Bond down terminals to counterpoise ground ring conductor.
- E. Bond grounded metal bodies on structure within 12 ft. of ground to counterpoise ground ring conductor.

3.02 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.03 FIELD QUALITY CONTROL

- A. Periodic Inspections: Engage an LPI inspector to perform periodic inspections during construction and at its completion, according to LPI-177.
- B. UL Inspection: Apply for inspection by UL as required to obtain a UL Master Label

for system.

END OF SECTION

SECTION 16900
SCADA

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the requirements for SCADA (i.e. PLC, HMI, subsystems, equipment, components, devices, materials, accessories and software). Provide all completion services specified herein, including final system performance verification to ensure the SCADA is complete and operational, and functions as specified.
- B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through 17 Specification Sections, apply to the Work of this Section as if specified herein.

1.02 QUALITY ASSURANCE

- A. Listing and Labeling: Provide electrical components, devices, and accessories that are Listed and Labeled as defined in NEC, Article 100, by a testing agency acceptable to the County, and marked for the intended use.
- B. SCADA Integration Firm: The Contractor shall arrange, coordinate, schedule, and pay for the services of a qualified SCADA Integration Firm to complete the work of this Project associated with the existing PLC based automation and control system. Firms shall be considered a "qualified SCADA Integration Firm" if they have:
 - 1. Provided engineering, design, installation, programming, HMI graphical display screen development, checkout, testing, start-up, and maintenance services in connection with PLC based automation and control systems at municipal water treatment plants (WTP) and/or waste water treatment plants (WWTP), on a continuous basis for at least the past 6 years, and can present representative documentation indicating that the firm has rendered such services. Such documentation shall include job summaries for at least one job performed in each of the past 6 years. Such documentation shall be submitted to the County for review and approval. Each job summary shall include the name of the job, job start and job end month/year, the name and description of the facility, the scope of the SCADA work including the approximate number and the types of I/O involved, the manufacturer and product series of the PLC equipment involved, the facility Owner's name, and the name and phone number for the facility Owner's Representative with knowledge of the job, and
 - 2. An experienced systems technician on staff that has successfully completed the hardware and software application engineering and software programming training courses for the exact type existing PLC equipment required to be modified as part of this Project, and

3. Continually maintain a field service department staffed by experienced technicians who are accessible 24 hours a day, 7 days a week for technical telephone (voice) consultation and remote dialup (data) troubleshooting, and who are available for immediate dispatch to the project site at a moments notice with the capability of being at the project site within 4 hours of a request for on-site assistance.
- C. **Systems Technician:** Upon award of the Contract, the SCADA Integration Firm shall designate an experienced Systems Technician to manage the work of this Project. This Systems Technician shall be considered experienced if she/he has a documented history of successful experience for the most recent 4 years past, in the design, system application programming, installation, checkout, testing, startup, and maintenance of at least four (4) systems of similar size and complexity. This Systems Technician shall be the main point of contact for the County and Engineer, for the duration of the Project and shall not be reassigned to another project until the work of this Project is complete, unless a change of personnel is requested by the County or Engineer, or a written change of personnel request is submitted to, and approved by the County. Approved replacement Systems Technician shall meet or exceed the requirements specified for the Systems Technician.
 - D. **Field Technicians:** The SCADA Integration Firm shall provide the services of experienced Field Technicians as required to complete the work of this Project. Field Technicians shall be considered experienced if they have a documented history of successful experience for the most recent 4 years past, in the design, system application, programming, installation, checkout, testing, startup, and maintenance of at least four (4) systems of similar size and complexity.
 - E. **Installations:** All work specified to be provided by the SCADA Integration Firm must be accomplished by trained mechanics and/or electricians in the continuous employment of the approved SCADA Integration Firm.

1.03 COORDINATION

- A. **General:** The SCADA Integration Firm and Contractor shall coordinate the Work of this Section with the work of all other Division 1 through 17 Specification Sections Contractors as well as the equipment suppliers.

1.04 SCOPE OF WORK

- A. **General:** The Contractor shall complete all work not specified to be completed by the SCADA Integration Firm. The SCADA Integration Firm shall provide the materials, tools, and labor to complete the following:
 1. Provide new SCADA panel for the new Influent Structure (Headworks) facility as conveyed by the Contract Drawings and specified herein.
 2. All rework and new work in the existing Headworks (influent structure) SCADA panel required to complete the installation of the new Headworks

(influent structure) SCADA panel.

3. Termination of SCADA communications cabling in existing and new Headworks' (influent structures) SCADA panels. SCADA communications conduit/cabling shall be provided by the Contractor.
4. Termination of SCADA field cabling/wiring at field instruments and inside new SCADA panel. SCADA field conduit/cabling/wiring shall be provided by the Contractor.
5. All new PLC subroutine programming code as required to complete the specified SCADA system installation, including providing all OEM and third-party software necessary to accomplish this work.
6. Modification of existing PLC HMI software setup and existing HMI graphical display screens, and creating new PLC HMI graphical display screens, as required to complete the specified SCADA installation, including providing all HMI and third-party software necessary to accomplish this work.
7. Prepare and submit, via the Contractor, all specified submittals.

B. Sequence of Operation:

1. General: The intent is for all new I/O to be processed (recorded, manipulated, and annunciated) in a similar fashion to that employed for existing I/O.
2. New Discrete Input Status Points: The SCADA Integration Firm shall review the existing SCADA programming code for subroutines related to the processing of discrete input status points, and shall implement similar subroutines for new discrete input status points.
3. New Discrete Input Alarm Points: The SCADA Integration Firm shall review the existing SCADA programming code for subroutines related to the processing of discrete input alarm points, and shall implement similar subroutines for new discrete input alarm points.
4. New Influent Flow Rate Analog Input Point: The SCADA Integration Firm shall develop and deploy the subroutine programming code required to process the influent flow rate analog input signal. This influent flow rate 4-20mA analog input signal shall be generated by the flow meter and shall be scaled from No Flow to Full Flow. The SCADA Integration Firm shall coordinate the flow rate scale (GPM, GPH, GPD, or MGPD) to be displayed with that desired by the County.
5. Implementation/Deployment: The SCADA Integration Firm shall load, checkout, test, demonstrate, and place back into service, the existing modified programming code.

C. HMI Graphical Display Screens:

1. General: New HMI display screens and graphics for the new equipment and instrumentation shall be similar in form and function to those deployed by the existing SCADA system for similar existing equipment and instrumentation. The SCADA Integration Firm shall employ HMI graphical display screen development software, and shall replicate the applicable graphics for the new equipment and instrumentation. Where equipment graphics are based on the actual form (i.e. outline, plan, elevation, or perspective) of the equipment, the SCADA Integration Firm shall employ HMI graphical display screen development software to generate the new custom equipment graphics.
2. Existing and New Headworks (Influent Structure): Modify existing HMI display screen to display status, alarm, and data associated with both the existing and the new Headworks (Influent Structures) facilities. If the status, alarm, and data associated with the existing Headworks (Influent Structure) facility is on a separate dedicated display screen, then provide a similar separate dedicated display screen for the new Headworks (Influent Structure).
3. Implementation/Deployment: The SCADA Integration Firm shall load, checkout, test, demonstrate, and place back into service, the existing HMI, with the existing, existing modified, and new graphical display screens.

1.05 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.
- B. SCADA Integration Firm Qualifications: Submit documentation of qualifications demonstrating compliance with criteria specified in paragraph "QUALITY ASSURANCE" above.
- C. Systems Technician Qualifications: Submit documentation of qualifications demonstrating compliance with criteria specified in paragraph "QUALITY ASSURANCE" above.
- D. Field Technicians Qualifications: Submit documentation of qualifications demonstrating compliance with criteria specified in paragraph "QUALITY ASSURANCE" above.
- E. Product Data: Submit for the following:
 1. Cables.
 2. SCADA panel including all equipment, components, devices, and materials used to assemble the SCADA panel.
 3. Miscellaneous.
- F. HMI Graphical Display Screens: Submit computer generated color representations of proposed graphical display screens with existing and new elements and all modifications identified. Include existing graphical display screens that are to be

modified or copied, for comparison purposes.

- G. Software Documentation: Software documentation shall be provided, which, through text and illustrations will provide a complete understanding of the overall control system software structure and organization. It shall clearly and concisely describe each function and its implementation. The documentation shall be in sufficient detail to allow skilled programmers to add or delete functions and modify functions in support of changes in operating procedures. Software documentation shall be as defined in the following paragraphs:
1. Executive Program: The description of the executive program shall include a discussion of the flow of program data and the means of controlling that flow. Specific information shall include:
 - a. A description of the inputs and outputs and the processing of each subprogram.
 - b. The source, purpose and predicted rate of occurrence for all internal and external program interrupts.
 - c. Assignment of priorities and permissible cycle times for each subprogram.
 - d. Logic and timing functions.
 2. Program Ladder Logic Instruction: Program logic shall be provided to show the step-by-step instructions within programs developed explicitly for the control system. Where necessary, appropriate annotations and comment text lines shall be provided to supplement this data. Listings may be bound separately where length of routines and physical size of printouts advocates this approach.
 3. Discrete Output State Fail-Safe Mode Listing: A listing shall be provided showing each discrete output with the fail-safe state listed as closed, open or no change (from state immediately prior to entering fail-safe mode).
 4. Cross-Reference listings: A cross-reference listing shall be provided relating each data name to the location of every statement referring to it and relating each routine to the location of every other routine calling upon it. The list shall be exhibited as a sequential table in alphanumeric order.
 5. Load Maps: The format, method, and location in which the various components and portions thereof are loaded into the software memory shall be described. This mapping shall include delineating all of the portions of the program that are to be concurrently resident in the device in question and the location and size of each portion of the program. If the system has more software, this information shall be provided for each configuration of mode.
 6. Subroutines: Subroutine logic shall be provided to show the step-by-step instructions within the subroutines. Appropriate text shall be provided to

supplement this data. Provide all logic for subroutines used to interface PLC with peripheral or foreign devices.

- H. Shop Drawings: Submit detailed Shop Drawings consisting of plans, elevations and schematic termination diagrams, showing interior and exterior dimensions, interior and exterior features, weights, construction details, component, device and material layout and mounting methods for each custom assembled control cabinet. Include complete I/O listings and detailed point-to-point schematic termination diagrams differentiating cabling/wiring internal to cabinets from cabling/wiring that extends outside of cabinets, and identifying cable/wiring characteristics. Schematic termination diagrams shall designate input modules by name, rack, module and terminal location and shall include cable/wire alphanumeric identification designations with device cross-references. All Shop Drawings shall have page, sheet and line numbers.
- I. Operation and Maintenance Manual: Submit word processed (MicroSoft Word) instruction manuals describing system operation and maintenance procedures including sections for final program printout, I/O points listing, routine inspection and preventative maintenance schedules, spare parts lists, as-built Shop Drawings and CDs. CDs shall specifically contain the following as a minimum: operation and maintenance manual text, including graphics, in MS Word format, all other operation and maintenance manual exhibits in scanned TIF format, as-built shop drawings in AutoCAD 2008 format, final programs and all software necessary to view, modify, save, and download/upload program from/to PLC. All CDs shall have logical directory and subdirectory structures so as to make navigating the CD intuitive. Each directory, subdirectory and file shall have a logical descriptive title. Manuals shall include hard covers and dividers with suitable titles, table of contents and glossary of terms. Manuals shall be printed on durable grade 60# white paper stock and bound within a sturdy D-ring binder of appropriate size. Where multiple binders are required to contain operation and maintenance data, all binders comprising Operation and Maintenance manuals shall be similar in appearance and organization. The SCADA Integration Firm, via the Contractor, shall deliver eight (8) copies to the County and one copy to the Engineer upon Substantial Completion. The SCADA Integration Firm and Contractor shall grant the County license to freely copy Operation and Maintenance manuals without limit as to the duration of the license or the number of copies.
- J. Commissioning Plan: Submit word processed instructions describing step-by-step commissioning procedures including commissioning schedule, PLC cables/wiring, PLC and workstations, field cables/wiring and field device inspection, adjustment, testing and checkout checklists.
- K. Software: Submit licensed OEM software CDs with accompanying User documentation and proof of original licensee registration, for each installation of each software package deployed in connection with the operation of the fueling system controls. All OEM software original licenses shall be registered on the behalf

of and in the name of the County. Coordinate County name, address, phone number, contact person(s) and other information specifics, required for license registration, with the County before procuring any OEM software.

PART 2 - PRODUCTS

2.01 SCADA

- A. Provide products in sizes and capacities indicated, and as required by the application, conforming to manufacturers' standard materials and components as published in their product information.
- B. All furnished products, including those referenced in this Section by manufacturer and product series, will be acceptable subject to fulfilling applicable system and Contract requirements. Where products are referenced herein or on the Drawings by manufacturer and product series "or approved equal," the SCADA Integration Firm is free to propose alternative equivalent products. "Equivalent products" shall be understood as "products of equivalent or better performance, products with at least the same type functionality and capacities, products with at least the same type, quantity and styles of features and accessories, products constructed of the same type and same or higher quality of materials, products constructed of the same or higher strength materials, products constructed of the same or higher durability materials with the same or better resistance to corrosion, products of the same or better performing construction and products that fulfill all system and Contract requirements."
- C. Where products are referenced herein or on the Drawings by manufacturer and product series "or approved equal" and the product series listed is no longer offered by the manufacturer, the SCADA Integration Firm shall refer such products to the Engineer her/his resolution. Failure to follow this directive shall constitute an agreement on the part of the SCADA Integration Firm to provide equivalent products, without additional compensation. The SCADA Integration Firm shall further agree that the determination of the equivalence of the products proposed by the SCADA Integration Firm, to products referenced herein shall rest solely with the Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Install all system components in accordance with the Drawings, manufacturers' recommendations, and approved submittals. Provide all necessary interconnection, services, and adjustments necessary for complete, operational and fully functional installations.
- B. All electrical work shall be accordance with the applicable requirements of the NEC and Division 16 Specification Sections.
- C. Install all SCADA cables and wires complete from SCADA panel termination point

to equipment/instrumentation termination point, without intermediate splice.

3.02 INSTALLATION

- A. Inspect work in progress for compliance with manufacturer specified tolerances.

3.03 IDENTIFICATION

- A. General: Label cables and wires at each end and at accessible junction points in accordance with the Specification Section 16075, "Electrical Identification." Apply established alphanumeric identification scheme to uniquely identify each cable and wire.

3.04 TESTING

- A. General: Provide County-approved operation and acceptance testing of the complete system. The County will witness all tests.
- B. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before placing the system on-line. All testing, calibrating, adjusting, and final field tests shall be completed by the SCADA Integration Firm. Provide a detailed cross-check of each new I/O point by comparing it in real time with the actual field condition. Submit the results of functional and diagnostic tests and calibrations to the County for final system acceptance.

3.05 CLEANING

- A. Clean exposed surfaces and restore finish where scratched or marred.

END OF SECTION

DIVISION 17
INSTRUMENTATION

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 the North Water Reclamation Facility (NWRF) 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 as shown on the drawings and specified herein.

1.02 RELATED WORK

- A. Division 16 - Electrical

1.03 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.

1.04 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 36-inch ductile iron pipe, raw wastewater, 100 psi max pressure, and unidirectional flow.

2.02 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.

2.03 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 influent structure. 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.

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 influent structure. 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. The Owner'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 Owner 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
for
INFLUENT STRUCTURE
NORTH REGIONAL WASTEWATER TREATMENT PLANT
MANATEE COUNTY, FLORIDA

BY

URS CORPORATION
Tampa, Florida

March 10, 2008

*Geotechnical Report for
Influent Structure
North Regional Wastewater Treatment Plant
Manatee County, Florida*

**GEOTECHNICAL REPORT
for
INFLUENT STRUCTURE
NORTH REGIONAL WASTEWATER TREATMENT PLANT
MANATEE COUNTY, FLORIDA**

**URS CORPORATION
Tampa, Florida**

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Keith Q. Giang, P.E.

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1. INTRODUCTION

URS Corporation (URS), under contract with the Manatee County Government (the County), is preparing plans for the County's proposed expansion of the Influent Structure project at the North Regional Wastewater Treatment Plant. The proposed construction includes grit removal chambers / storage tanks and associated mechanical, electrical, piping and civil site works. A stormwater retention / detention pond is also included in the project. The proposed construction will be within the existing property limits. URS was also tasked by the County to perform a subsurface soil investigation program for the proposed construction. This report summarizes the subsurface soil conditions encountered at the proposed project location and provides soil design parameters and recommendations for the foundation design.

The approximate project location is shown on the **Location Map (Figure 1)**.

2. PURPOSE AND SCOPE OF WORK

The purpose of this study is to provide an evaluation of the subsurface soil conditions at the proposed Influent Structure and retention pond locations. To accomplish this objective, the scope of work included the following:

1. Review existing available geotechnical information in the vicinity of the project, including the USDA Soil Conservation Service, Soil Survey of Manatee County, Florida.
2. Perform a site exploration program consisting of 3 Standard Penetration Test (SPT) borings in the vicinity of the structure and two auger borings inside the proposed retention pond. The SPT borings were extended to depths of approximately 25 to 40 feet and the auger borings were drilled to depths of 10 feet below the existing ground surface.
3. Estimate the seasonal high groundwater elevation and measure the groundwater elevations in the borings.
4. Perform two double-ring infiltration tests near the pond borings and determine the permeability value of the subsurface soil in the area.
5. Perform a limited laboratory testing program on representative soil samples to verify field classifications and to assess engineering properties.
6. Prepare this report summarizing the results of the investigations and recommendations.

3. SITE EXPLORATION

The site exploration program was performed on October 17 and 18, 2007. Two 40-foot Standard Penetration Test (SPT) borings (Boring B-1 and B-2) and one 25-foot SPT boring (Boring B-3) were drilled at the proposed structure location. Two 10-foot auger borings were drilled in the proposed stormwater retention / detention pond location. Two Double-ring Infiltration tests (DRI) were conducted adjacent to the pond borings. The testing depth was at 1 to 2 feet below the existing ground surface. The boring locations were developed and staked by URS using the project site plan. Underground utilities were located by the County staff.

The approximate boring locations are shown in **Figure 2, Boring Location Plan**. The soil boring logs are shown in **Appendix A**.

The SPT borings were advanced by a truck-mounted drill rig and were completed in general accordance with procedures described in ASTM D-1586. Penetration tests were performed at 2.5-foot intervals for the first 10 feet from ground surface and at 5-foot intervals thereafter to boring termination depths. Disturbed split spoon samples of the soils encountered in the borings were recovered for visual examination. Representative samples were selected for subsequent laboratory testing. The auger borings in the pond area were completed in general accordance with procedures described in ASTM D-1452. The DRI tests were performed in general accordance with procedures described in ASTM D-3385. Groundwater level encountered at each location was recorded at the time of the boring completion. All completed bored holes were grouted in accordance with the Southwest Florida Water Management District guidelines.

The field investigations and laboratory testing were performed by Elite Drilling, Inc., under the contract with URS.

4. LABORATORY TESTING

The laboratory testing program included classification tests consisting of grain size analyses, natural moisture content and Atterberg limits tests performed on representative samples from the borings. The laboratory tests and frequency are as below:

<u>Type of Test</u>	<u>Number of Tests</u>
Grain Size Distribution	6
Moisture Content	6
Atterberg Liquid and Plastic Limits	2
Unconfined Compression	1

A summary of laboratory test results for the project is provided in **Table 1**. The laboratory test results are included in **Appendix B**. The results of laboratory tests confirmed the visual classifications of soil samples during the drilling. An unconfined compression test for strength parameters of cohesive material was attempted on an undisturbed (Shelby Tube) sample collected from 35 to 37 feet below the ground surface in Boring B-2. However, the results were erratic due to several sand seams occurred in the sample. It was judged that results of the strength tests are unsuitable for use and therefore are not included in the report.

5. SITE CONDITIONS

5.1 SUBSURFACE CONDITIONS

The soil classifications shown on the boring data are in general accordance with the Unified Soil Classification System (USCS) based on observed soil characteristics and results of laboratory testing. The boring elevations shown were surveyed as part of the project preparation. The data provided represent conditions encountered only at each boring location. Varying degrees of non-uniformity of the horizontal and vertical soil conditions are likely to exist in between boring locations.

From the United State Department of Agriculture (USDA) Soil Conservation Service, Soil Survey of Manatee County, Florida, the near surface natural soil in the project vicinity belongs to the Eauggallie Fine Sand and the Floridana Fine Sand Soil groups. The Eauggallie Fine Sand consists mostly of fine sand (SP, SP-SM) in the upper 3 to 4 feet from ground surface and again at about 4.5 feet below surface to beyond the survey depth. Fine sand with some silt and clay (SM, SM-SC) was shown sandwiched between the fine sand layers. The Eauggallie Fine Sand Soil group is highly permeable (0.6 to 20.0 inches per hour) and possesses pH values ranging from 4.5 to 7.8 with the lower pH values shown in the upper fine sand layer. The Floridana Fine Sand consists mostly of fine sand (SP, SP-SM) in the upper 2 to 3 feet from ground surface and again at about 4.5 feet below surface to beyond the survey depth of 6.5 feet. Silty to clayey fine sand (SM, SM-SC) was shown sandwiched between the fine sand layers. The top sand layer is highly permeable (6.0 to 20.0 inches per hour) and the silty sand layer has lower permeability value (0.2 inches per hour). The soil layers have pH values ranging from 5.6 to 8.4. The groundwater table is within 10 inches of the surface for 1 to 4 months and from 10 to 40 inches for more than 6 months of the year. Recent development of the site may have altered the properties and characteristics of the near surface soils.

The subsurface materials encountered during this exploration generally consisted of layers of fine sands (SP), sands with some silt (SP-SM, SM) and clayey fine sand (SM-SC, SC). The fine sand layer occurred from the existing ground surface to a depth of about 5 feet. The sand with some silt layer was found below the surficial sand to about 10 feet below the ground surface. The clayey sand layer was found below the two previous layers and to the boring terminus.

Seams of Plastic Clay (CH) were found between 30 to 40 feet below the ground surface in borings B-1 and B-2. The consistency of the surficial sand layer varies from Medium Dense to Dense. The sand with silt layer can be classified as Loose to Medium Compact in consistency. The clayey sand layer has consistency of Stiff to Very Stiff. The clayey sand layer was found to have a Hard consistency at the tips of borings B-1 and B-2.

Groundwater was measured to be about 6.5 to 8.0 feet below the ground surface after the completion of the drilling.

The double-ring infiltration tests, performed at depths of about 1 to 2 feet below the existing ground surface in the proposed pond area, show the near surface soil having permeability values of about 0.2 to 0.6 inches per hour.

5.2 SINKHOLE POTENTIAL

From a regional standpoint, the west central and central Florida regions are prone to sinkhole development. However, the borings performed for the project do not indicate the presence of a sinkhole or old sinkhole remnants.

It should be noted that sinkhole assessment for the area is beyond the scope of this report. The discussions included herein are intended to bring out the awareness of sinkhole potential for the site.

5.3 GROUNDWATER

The historical seasonal high groundwater levels for the project were estimated using the USDA Soil Conservation Service, Soil Survey of Manatee County. The estimated seasonal high groundwater is at approximately 1 foot below grade. Seasonal fluctuations in the groundwater level should be anticipated.

The groundwater level encountered in the borings is fairly deep comparing to groundwater levels described in the Soil Survey. Recent development of the site, including drainage ditches, swales and retention/detention ponds may have altered the groundwater level condition from its historical level. It is suggested that the historical seasonal high groundwater level be adjusted to account for the influent of the nearby water courses.

6. ANALYSES AND RECOMMENDATIONS

6.1 SOIL DESIGN PARAMETERS

Using corrected SPT blow counts and established geotechnical references along with soil descriptions/classifications, soil design parameters were correlated. Soil design information

such as relative density, angle of internal friction or Phi Angle and soil cohesion of the subsurface soils were derived. The parameter derivation was performed for all soil layers encountered in the borings.

Summaries of the soil design parameters are shown in **Table 2** and are included in the boring log sheet (**Attachment A**).

6.2 FOUNDATIONS

From the project information, the influent structure is an elevated, cast in place concrete holding tank and transfer station. When fully loaded, the holding tank will contain approximately 21 feet of water and suspended solids. The bottom of the tank is approximately 10 feet above finished grade. From the project plans, there are numerous pipes and connections attached to the structure which require that ground settlement be kept to a minimum level.

Shallow spread footings and deep foundations systems including Augered Cast-in-Place piles (ACIP) and driven prestressed, precast concrete square piles were analyzed for the project. Brief descriptions of each foundation system and the results of the analyses are as follow.

6.2.1 Shallow Foundations

Based on preliminary structural analysis, a contact pressure of approximately 2,000 to 3,000 pounds per square foot will be imposed onto the ground via shallow spread footings. The imposed soil pressure is estimated to cause approximately 2 to 3.5 inches of total settlement and potentially 1 to 1.5 inches of differential settlement. The results of the preliminary shallow foundation analyses are summarized in **Table 3** below. The settlement estimations are included in the **Appendix C**.

Table 3: SUMMARY OF SHALLOW FOUNDATION ANALYSES

Footing Size	Allow. Bearing Capacity (KSF)	Estimated Settlement (In.)
6' X 14'	2.5	1.0
8' X 14'	2.5	1.5
22.5' X 22.5'	2.5	3.3
22.5' X 22.5'	2.0	2.6
22.5' X 22.5'	1.5	1.9

The resulting settlement may exceed the tolerable limits allowed by the structure.

Deep foundation alternatives were examined. These include Auger Cast-in-Place Pile foundation and driven prestressed, precast concrete square pile foundation (Driven Piles).

6.2.2 Auger Cast-in-Place Piles (ACIP Piles)

ACIP piles are typically constructed by rotating a hollow-stem continuous flight auger into the ground until the planned tip depth or termination criterion is achieved. At the termination depth, a high slump viscous grout is pumped under pressure into the hole through the hollow stem auger. As positive pressure is developed in the drill string, the auger is slowly withdrawn up the hole and the ACIP pile is constructed. Depending on the structural load resistance requirement, reinforced steel cages/steel bars are inserted into the plastic grout column, creating a reinforced pile.

The ACIP piles are much more economical and have higher production rate than conventional drilled shafts, yet offer similar advantages of low noise and low vibration during foundation construction. The disadvantages of the ACIP piles include the requirement of a specialty contractor and strict construction monitoring and quality control processes.

The ACIP piles derive load carry capacity from the skin friction between the periphery of the grouted pile and the soil through which the pile penetrates. The FHWA method for computing drilled shaft capacity has been adopted by the Florida Department of Transportation (FDOT) as the standard method for calculating ACIP pile capacity. Ultimate axial compression capacity of ACIP piles embedded in sand is computed as follow:

$$P_u = F_s * A_s$$

Where: P_u = Ultimate Axial Compression Capacity (T)

F_s = Side Friction coefficient, $F_s < 2.1$ TSF.

$$F_s = P'_v * \text{Beta}'$$

P'_v = Effective Vertical Stress of the soil at depth Z (TSF)

Beta' = Critical Resistance Coefficient

$\text{Beta}' = \text{Beta} * N/15$ where $\text{Beta}' < \text{Beta}$

$\text{Beta} = 1.5 - 0.135 * Z^{0.5}$ with $1.2 > \text{Beta} > 0.25$

Z = Depth in feet.

N = SPT Blow Counts

A_s = Surface area = $A_p * L$

A_p = perimeter of ACIP (Ft)

L = embedment length of the ACIP (Ft).

Typical ACIP pile diameters used for structural foundations on similar project often range from

14 to 18 inches. The Florida Building Codes require that an ACIP length not exceed 30 times its diameter and the maximum axial compression stress imposed on the pile not exceed 25 percent of the grout strength. Grout strength used for ACIP piles varies from 4,000 PSI to 7,000 PSI. The lower value is the typical value used in Florida and thus recommended for this project. The results of the ACIP piles foundation analyses are as follows.

Table 4: SUMMARY OF ACIP PILE CAPACITY – 4,000 PSI GROUT STRENGTH

Pile Diameter (In.)	Maximum Pile Length (Ft)	Allowable Axial Capacity (Kips)
14	35	40
16	40	60
18	40	70

The pile length was limited to 40 feet due the maximum depth of boring drilled. ACIP pile capacity calculations are included in **Appendix D**.

6.2.2.1 Augered Cast-In-Place Pile Foundation Recommendations

The successful usage of the ACIP piles as structure foundations depends greatly on the quality of the construction. The selected contractor should be an experienced specialty contractor having install ACIP piles in projects similar in size and magnitude to this project. The ACIP piles installation and quality control program shall be in strict accordance with the guidelines from the Deep Foundation Institutes and Section 455 of the FDOT Standard Specifications for Road and Bridge Constructions, 2008. Some highlight requirements and recommendations are listed below.

6.2.2.2 ACIP Pile Installation

Recommendations for ACIP pile installation are presented hereafter:

- We recommend that the piles be spaced at least 3 pile diameters apart center-to-center to minimize pile capacity reduction caused by group effects. A horizontal placement tolerance with respect to the design center of 3 inches should be specified for group piles and 1 inch for isolated piles unless more stringent construction positioning is required. Out-of-plumb vertical tolerance for the piling should be limited to 2 percent maximum.
- The installation of adjacent piles located within 5 feet of each other on the same working day is not recommended. Adjacent piles located within 5 feet shall not be installed until the initial grouted pile has set for 24 hours.
- The 28-day unconfined compressive strength of the grout used should be at least 4,000 pound per square inch (PSI).

- In order to provide some assurance that the pile has been constructed with a continuous cross-section, a full-length steel reinforcing bar should be installed at the center of each pile immediately after grouting. Centralizers should be attached to individual bars and at a maximum vertical spacing of 10 feet. Additional reinforcing should be provided as needed for structural considerations.

- Piles subject to uplift due to wind load must be provided with adequate reinforcing steel throughout the entire pile length. Steel reinforcement cages can be used to improve structural capacity of the piles in resisting lateral bending.

6.2.2.3 Drilling and Grouting

Prior to actual installation of any piles, the Contractor should demonstrate that the materials and equipment proposed for use are capable of installing production piles of the required sizes and depths. The Contractor shall also provide an accurate method of determining the depth and alignment of the auger as well as the grout pump be calibrated prior to initiation of production pile installation. Grout volumes, as much as 1.3 times the theoretical pile volume or higher, may be required for proper pile installation. The grout factor is defined as the actual volume of grout pumped into the pile divided by the theoretical volume of the drilled hole.

After achieving the desired depth, a positive grout pressure should be observed prior to initiating withdrawal of the auger. A continuous fluid return consisting of slurry and then grout at the top of the hole is the best indication that the desired pressure head is being achieved.

The auger should be withdrawn slowly so that a positive grout pressure is maintained in the hole at all times during auger withdrawal. If the withdrawal of the auger becomes erratic, grout pressure suddenly drops, or if the grout is interrupted, the auger tip should be reinserted at least 5 feet below the level where the grouting operation was disrupted prior to resuming withdrawal of the auger.

Some subsidence of fresh grout may occur in the top of the pile. This subsidence is, in part, a result of the weight of the grout column "pushing" laterally into pores/voids in the subsoil layer. We anticipate that subsidence will occur within a period of approximately two hours following the grouting operation. If subsidence occurs while the pile grout is in a fluid state, we recommend that the pile be immediately filled with fresh grout to the proper cutoff elevation. We recommend that a pile grout subsidence of up to 8 inches be considered acceptable. Grout should not be pumped into the pile when it is older than 90 minutes from the time it was batched.

6.2.2.4 ACIP Pile Monitoring

The successful augered cast-in-place pile installation will in large part depend upon the expertise of the Contractor and the techniques used. Full-time inspection must be maintained during installation to monitor depths and the amount of grout pumped versus the rate of auger withdrawal. The full-time monitoring of pile installation will provide a degree of assurance that continuous piles of the proper cross-section are being constructed.

6.2.3 Driven Prestressed, Precast Concrete Square Piles

Prestressed, precast concrete piles are a suitable foundation alternative for the proposed project. Square concrete piles are readily available in a variety of sizes and, generally in Florida, have a lower cost per ton of capacity than other pile types. The main advantages are the relatively short lengths needed to achieve the necessary capacity and the lower installation costs, compared with other deep foundation types. The disadvantage of concrete piles is the greater difficulty in splicing and/or cutting of piles that terminate at depths other than those required for design cutoff. Other disadvantages of these foundations are pile drivability and the noise and vibration associated with pile-driving operations.

For the anticipated foundation load, 14-inch square piles would provide adequate capacity for the project. The 14-inch piles will require smaller pile driving equipment and therefore would have lower installation cost. The 14-inch square pile is recommended for analyses.

6.2.3.1 14-Inch Pile Allowable Axial Capacity

The pile axial capacity was computed using the FB-Deep computer program developed by the University of Florida for the FDOT. The program uses SPT blow counts and soil types encountered during drilling to generate graphs of capacity versus pile tip elevations. Based on these capacity curves, subsurface soils encountered and our experience, the maximum allowable pile capacities are recommended as follows.

Table 5: ALLOWABLE AXIAL CAPACITY OF 14-INCH CONCRETE PILES

Pile Length (Feet)	Allowable Axial Capacity (Kips)
30	80
35	110
40	140

Pile capacity calculations are included in **Appendix E**.

Approximately 25 percent of the axial compression capacity can be used as tension capacity of the pile. If required, detailed analyses of the pile tension capacity can be performed for refined values.

6.2.3.2 Pile Foundation Design Recommendations

We recommend that the center-to-center spacing of the piles be at least 3 pile side widths/diameters according to the FDOT's Structure Design Guidelines to prevent pile capacity reductions and tip settlements caused by group effects. Should the pile spacing be reduced for economic reasons, we can provide assistance in evaluating pile group capacity reduction and possible punching failure of the group.

6.2.3.3 Pile Installation Recommendations

All piles to be used in this project should conform to the FDOT specifications regarding precast prestressed concrete piles, and to the latest version of FDOT Specifications Section 455. Pile installation procedures, protection of existing facilities, monitoring programs, and other related topics shall also be in accordance with the specifications.

Piles should be driven to the Required Driving Resistance as established in the plans. The Required Driving Resistance should be the product of the factored design load times a safety factor. It is recommended a minimum safety factor of 2.0 be used for this project.

Prior to actual installation of any piles, the Contractor should perform Wave Equation Analyses to determine the proposed pile installation equipment is capable of installing production piles of the required sizes and depths. The County or its qualified representative should review all equipment proposed for use. The selected pile driving hammer should be capable of operating at reduced energy levels (approximately one-half of its rated energy or less). Pile driving at a reduced hammer energy should be performed when advancing piles through soft or loose material, and when the pile driving resistance is relatively low (generally less than 10 to 20 blows per foot of penetration) to prevent tension stress damage to the piles. The contractor should be required to reduce the energy being delivered to the pile to prevent high driving stresses and possible damage to the pile when pile driving tip resistances are relatively low.

During pile driving operations, driving records should be kept for each pile detailing pertinent information such as the pile type, length, date driven, and blow counts. The capacity of each pile should be reviewed based on its final tip elevation and driving record.

6.3 SITE PREPARATION

From the results of the investigations, there were no conditions that would preclude the proposed

construction. Prior to the excavation/grading process, the proposed construction limits shall be cleared and grubbed. The work operations will generally consist of removal of all structures, fences, rubble, and debris from the site and clearing and grubbing of all trees, stumps from fallen trees, major root systems, and vegetation. Clearing and grubbing for construction of the facility along with any removal of plastic material shall be in accordance with FDOT Standard Index 500.

The cleared and grubbed surface should be compacted to at least 98 percent of the maximum dry density as determined by AASHTO T-99 method prior to placing any fill. Fill materials should be compacted in thin lifts of no more than 8 inches in loose thickness and should be compacted according to Section 120-9 of the FDOT Standard Specifications.

Materials used as backfill should satisfy the requirements of Select Fills as described in the FDOT Standard Index 505 and should be compacted in accordance with Section 120-9 of the FDOT Standard Specifications.

6.4 STORMWATER RETENTION PONDS

The pond boring and field permeability test results indicate there is no condition that would preclude the construction of the proposed pond. However, judgment should be used in application of the derived permeability values. These values should not be construed to represent the true pond exfiltration rate, since that depends on several factors including pond geometry, pond bottom elevation, construction procedures, and normal siltation of pond bottoms during operation.

6.4.1 Site Preparation

Prior to the excavation/grading process, the proposed retention / detention pond area shall be cleared and grubbed to removal of all structures, fences, rubble, and debris from the site including all trees, stumps from fallen trees, major root systems, and vegetation. Clearing and grubbing for construction of the facility along with any removal of plastic material shall be in accordance with FDOT Standard Index 500.

6.4.2 Excavation

Excavation and grading can be performed with conventional equipment such as pans, backhoes, and dozers. Topsoil should be removed and stockpiled prior to excavation. Qualified inspectors should monitor excavated materials to direct selective sorting of highly plastic soils and muck from suitable sandy soils. All different materials should be stored separately for later use. The storage areas should be cleared and grubbed to remove all rubble and debris, as well as grass and roots.

The excavated surface should be compacted to at least 98 percent of the maximum dry density as determined by AASHTO T-99 method prior to placing any fill. Replacement materials should be compacted in thin lifts of no more than 8 inches in loose thickness and should be compacted according to Section 120-9 of the FDOT Standard Specifications.

6.4.3 Material Usage

Based on the preliminary design and the results of the field investigations, the majority of the excavated material for the pond can be classified as Select Materials. A small portion of the excavated materials will be classified as topsoil and plastic / unsuitable materials. The classifications of these materials are as follows:

- Topsoils and unsuitable materials are those containing organic material regardless of classification. This layer can be found at the top 4 to 6 inches of the existing ground throughout the project site.
- Select materials are those complying with AASHTO soil classification groups A-3 and A-2-4 or a combination thereof. These select materials are found in Layers 1 and 2 of the borings. Materials in soil layer number 2 contain more than 15 percent by weight finer than the No. 200 sieve (tested in accordance with ASTM D 1140). These materials are like to retain excess moisture and be difficult to dry and compact. They should only be used as fill materials above the existing groundwater level at time of construction.
- Non-select soil materials are those not meeting the above definitions. These materials consist of FDOT defined plastic and high plastic materials (A-2-6, A-6, A-7, etc.) or a combination, thereof. These plastic materials are found in Layer number 5 of the borings.

Select materials are suitable for construction of the site improvements.

Non-select materials can be used in site improvements in areas outside of the load bearing prism and in accordance with the FDOT Standard Index 505. However, they may be difficult to dry, spread, and/or compact.

Topsoil and unsuitable materials are not recommended for construction of roadway embankment. They are, however, suitable for use as a muck blanket where landscaping and grassing will be introduced.

6.5 GROUNDWATER CONTROL

The need for groundwater control may arise depending on the design elevations of the deep foundation caps and excavation depth of the stormwater retention ponds. If required, groundwater drawdowns of 1 to 3 feet can be achieved by pumping from sumps located in perimeter pits or trenches. If deeper drawdowns are required, a single stage of fully sanded vacuum well points may be necessary. Generally, the groundwater level should be maintained at least one foot below planned excavation levels and two feet below compaction surfaces. Proper sediment, erosion, and pollution control measures will need to be incorporated into the contract documents. Discharge of dewatering effluent should be in accordance with state and local laws.

7. LIMITATIONS

Generally accepted soil mechanics and foundation engineering practices were used in the preparation of this report. This report has been prepared solely for our use in design and may not contain sufficient information for other use or purpose of other parties. If conclusions or recommendations based upon this data are made by others, such conclusions or recommendations are not our responsibility. No other warranty, either expressed or implied, is made as to the professional advice included in this report.

The depth of the groundwater table, where indicated, was measured in the borings at the time of investigation. Fluctuations in the level of the groundwater will occur due to seasonal and rainfall variations. Furthermore, other factors neither evident at the time of our investigation, nor reported herein, may significantly affect the level of the groundwater table. The engineering evaluations, opinions, conclusions, and recommendations presented in this report are based upon the data obtained from the subsurface investigation program.


Manmade variations in the site conditions in this urban area should be expected. This report does not reflect any variations that occur between boring locations except as discussed in this report. The nature and extent of subsurface variations between borings may not become evident until the construction phase. If variations then appear evident, performing additional on-site observations will be necessary during this phase of construction to note the nature of the variations in order to reevaluate and modify, if necessary, the recommendations presented in this report.

The following Figures, Tables and Appendices are attached and complete this report:

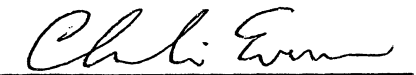
Figure 1	Location Map
Figure 2	Boring Location Plan
Table 1	Summary of Laboratory Test Results
Table 2	Summary of Soil Design Parameters
Appendix A	Soil Boring Logs
Appendix B	Results of Laboratory Tests and Field DRI Tests
Appendix C	Bearing Capacity and Settlement Estimations
Appendix D	ACIP Pile Capacity Calculations
Appendix E	Driven Pile Capacity Calculations
Appendix F	FHWA Geotechnical Report Review Checklist

Respectfully Submitted,

URS Corporation



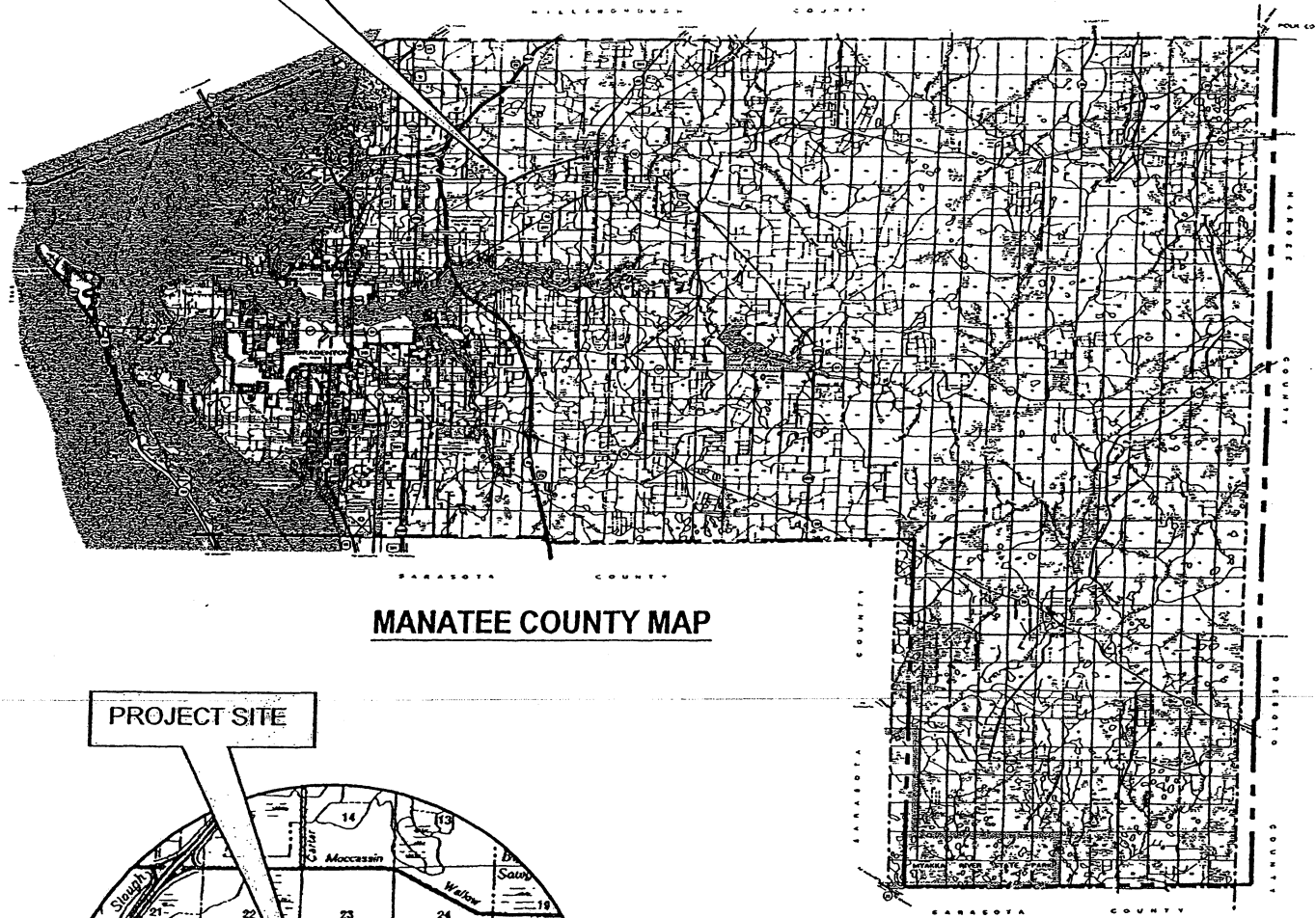
Keith Q. Giang, P.E.
Project Geotechnical Engineer



Charles H. Evans, P.E.
Geotechnical Group Manager

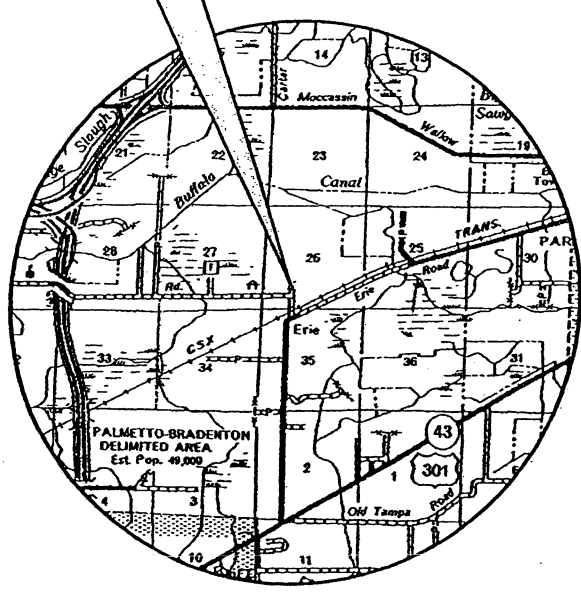
FIGURE 1
LOCATION MAP

SITE LOCATION

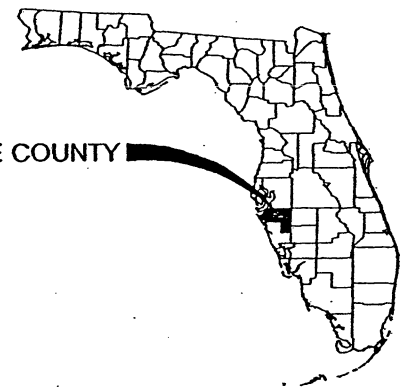


MANATEE COUNTY MAP

PROJECT SITE



SITE LOCATION MAP



FLORIDA STATE MAP

Not to Scale

NORTH REGIONAL WASTEWATER TREATMENT PLANT
 INFLUENT STRUCTURE
 MANATEE COUNTY, FLORIDA



LOCATION MAP

FIGURE 1

FIGURE 2
BORING LOCATION PLAN

TABLE 1

Summary of Laboratory Test Results

Table 1: Summary of Laboratory Tests

Boring	Depth	-200	MC	LL	PL
B-1	1.5' to 3.0'	6.3	5.6	--	--
B-1	6.0' to 7.5'	18.3	20.9	--	--
B-2	8.5' to 10.0'	19.1	22.9	N.P.	N.P.
B-2	35' to 37'	89.0	73.3	107.2	37.3
B-3	18.5' to 20.0'	27.9	28.0	--	--
B-5	0.5' to 2'	14.2	9.7		

Abbreviation

-200 = Percent Passing U.S. Standard Sieve No. 200
MC = Moisture Content (%)
LL = Liquid Limit
PL = Plastic Limit
N.P. = Non-Plastic

TABLE 2

Summary of Soil Design Parameters

Influent Structure
 North Regional Wastewater Treatment Plant
 Manatee County, Florida

ESTIMATED DESIGN SOIL PARAMETERS

BORING NUMBER	DEPTH (Feet)	SPT 'N' RANGE	APPROX. SOIL UNIT WEIGHT (pcf)		ANGLE OF FRICTION (Degrees)	UNDRAINED SHEAR STRENGTH (psf)
			MOIST	SUBMERGED		
B - 1	0 - 5	16 - 38	115	52.6	34	0
	5 - 10	8 - 9	110	47.6	30	0
	10 - 35	10 - 30	115	52.6	32	0
	35 - 40	30 - 55	125	62.6	0	4,000
B - 2	0 - 5	18 - 32	115	52.6	34	0
	5 - 7.5	7	110	47.6	30	0
	7.5 - 15	9 - 17	110	47.6	30	0
	15 - 35	9 - 26	110	47.6	30	0
	35 - 35.2	50 / 2"	125	62.6	0	4,000
B-3	0 - 5	16 - 24	115	52.6	34	0
	5 - 7.5	7	110	47.6	30	0
	7.5 - 20	12 - 18	115	52.6	32	0
	20 - 25	7	110	47.6	30	0

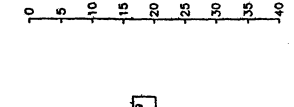
APPENDIX A
Soil Boring Logs

- SOIL LEGEND:**
- 1) SAND (SP)
 - 2) SAND W/SOME SILT (SP, SP-SM)
 - 3) SAND W/SOME CLAY (SP-SC)
 - 4) CLAYEY SAND (SC)
 - 5) CLAYEY SAND (SC)
 - 6) CLAYEY SILT (SP-SM)
 - 7) CLAYEY SILT (SP-SM)
 - 8) HIGHLY PLASTIC CLAY (CH)
 - 9) LIMESTONE (LS)
- LEGEND:**
- 200 Z-PASSING #200 SIEVE
 - MC MOISTURE CONTENT (%)
 - ORG ORGANIC CONTENT (%)
 - LL LIQUID LIMIT
 - LP PLASTICITY INDEX
 - PI PLASTICITY INDEX
 - GSE GROUND SURFACE ELEVATION
 - STANDARD PENETRATION RESISTANCE IN BLOWS/12 IN
 - N WEIGHT OF SAMPLER
 - WOR WEIGHT OF SOIL
 - (SP) UNIFIED SOIL CLASSIFICATION
 - PERMEABILITY VALUE FROM DOUBLE RING INFILTRATION TEST
 - UNDISTURBED SAMPLE (SHELEBY TUBE)

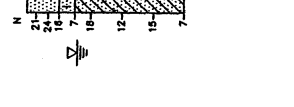
BORING B-1
GSE APPROX. 25.0
GROUNDWATER DEPTH = 8.0'
DATE: 10/17/07



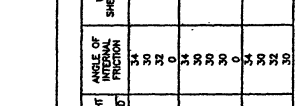
BORING B-2
GSE APPROX. 25.0
GROUNDWATER DEPTH = 7.5'
DATE: 10/17/07



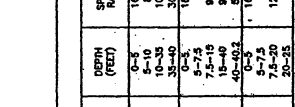
BORING B-3
GSE APPROX. 25.0
GROUNDWATER DEPTH = 7.5'
DATE: 10/17/07



BORING B-4
GSE APPROX. 25.0
GROUNDWATER DEPTH = 6.8'
DATE: 10/17/07



BORING B-5
GSE APPROX. 25.0
GROUNDWATER DEPTH = 6.5'
DATE: 10/17/07



ENGINEERING CLASSIFICATION

GRANULAR MATERIALS

RELATIVE DENSITY

VERY LOOSE 0 TO 4
LOOSE 5 TO 10
MEDIUM OR COMPACT 11 TO 30
DENSE 31 TO 50
VERY DENSE OVER 50

CONSISTENCY

VERY SOFT 0 TO 2
SOFT 3 TO 4
FIRM 5 TO 15
VERY STIFF 15 TO 30
HARD OVER 30

SOILS AND CLAYS

SET (BLOWS/FOOT)

0 TO 2
3 TO 4
5 TO 10
11 TO 30
31 TO 50
OVER 50

NOTES

- BORINGS ARE NOT TO SCALE HORIZONTALLY
- SEE SHEET C-1 FOR APPROXIMATE LOCATIONS
- NUMBER TYPE MANUAL
- SHALL PREP TYPE USE-79

BORING NUMBER	DEPTH (FEET)	SOIL DESIGN PARAMETERS		ANGLE OF INTERNAL FRICTION (φ)	UNSATURATED SHEAR STRENGTH (psf)
		SEPT. RANGE	APPROX. SOIL UNIT WEIGHT (pcf)		
B-1	0-5	18-38	115	34	0
	5-10	10-35	115	32	0
	10-35	30-55	125	32	4,000
B-2	0-5	18-32	115	34	0
	5-7.5	8-7	110	30	0
	7.5-10	8-28	110	30	0
B-3	0-5	18-24	115	34	0
	5-7.5	7	110	30	0
	7.5-10	12-18	110	30	0
B-4	0-5	18-24	115	34	0
	5-10	7	110	30	0

URS
7650 West Country Campbell Gateway
Tampa, Florida 33607 Fax: (813) 288-4887
Florida Engineering Number: 000202

PROJECT TITLE: PRELIMINARY NOT FOR CONSTRUCTION

C-7

SOIL BORING LOGS

INFLUENT STRUCTURE AT THE NORTH WATER RECLAMATION FACILITY
MANATEE COUNTY GOVERNMENT
MANATEE COUNTY, FLORIDA

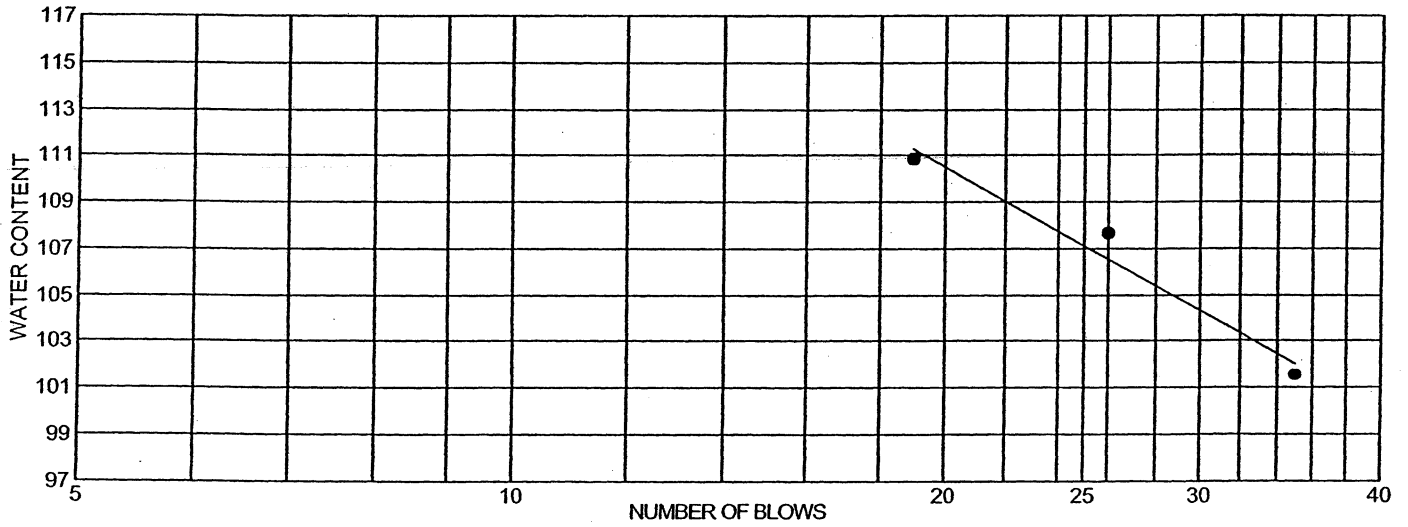
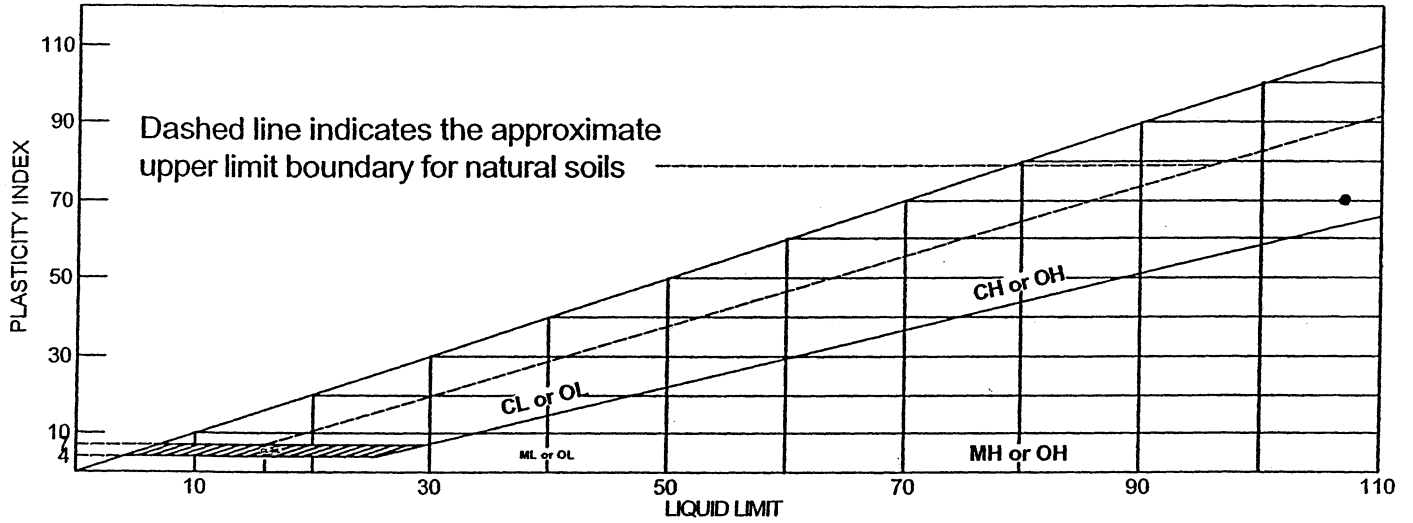
URS JOB NUMBER: 12007031
FILE: D. WILCOX
ENG: X. CHANG
DRN: D. ELLIS
FILE SAVE DATE: March 10, 2008

NO.	BY	DATE	DESCRIPTION	REVISIONS

APPENDIX B

**Results of Laboratory Tests
and
Field DRI Tests**

LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Moisture Content = 73.3%	107.2	37.3	69.9	100.0	89.0	

Project No. 04-07-0284 **Client:**
Project: North Region Waste Water
Location: B-2

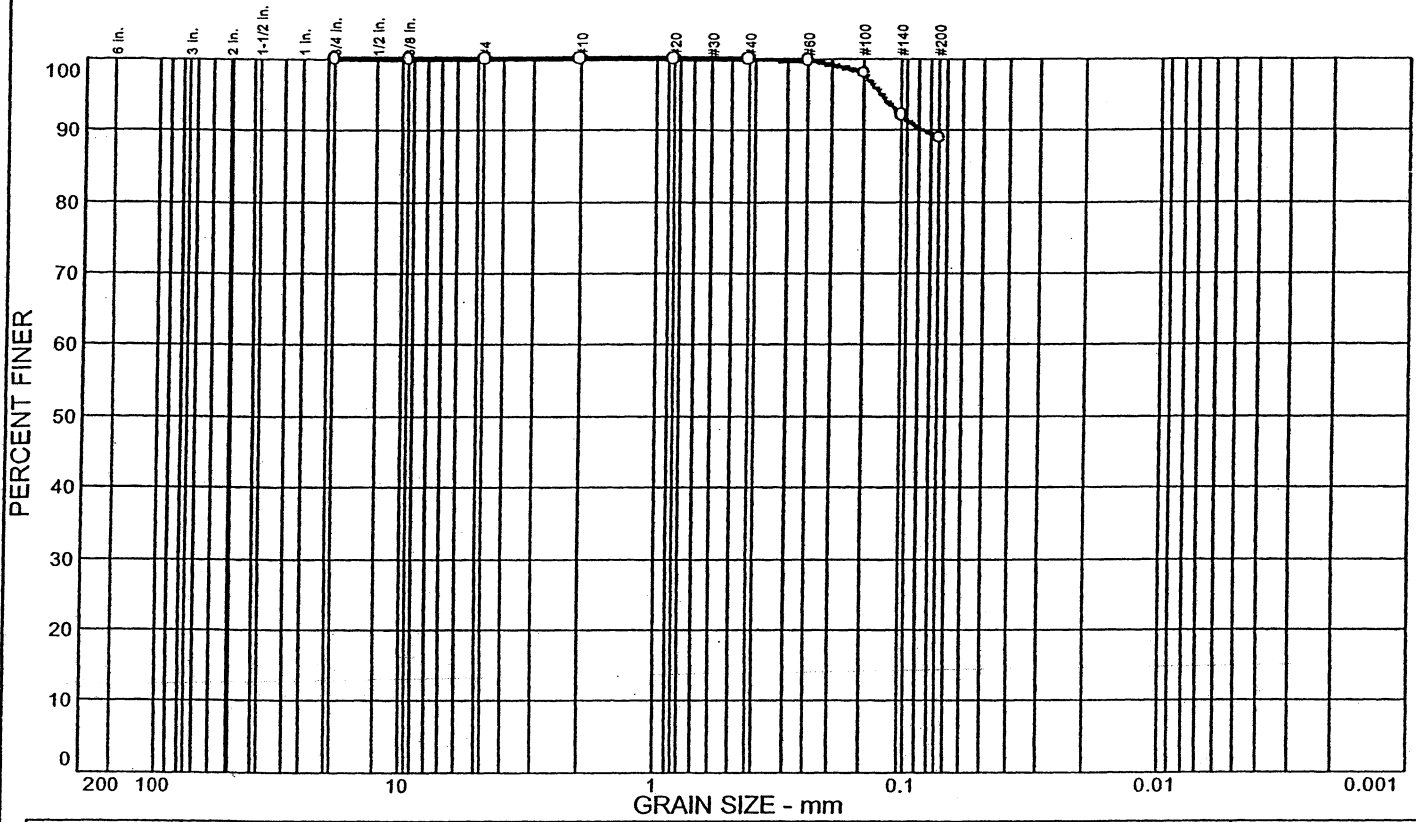
Nodarse & Associates, Inc.
Winter Park, FL

Remarks:

●

Plate

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	11.0	89.0	

<input checked="" type="checkbox"/>	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
<input type="checkbox"/>	107.2	37.3								

MATERIAL DESCRIPTION	USCS	AASHTO
<input type="checkbox"/> Moisture Content = 73.3%		

Project No. 04-07-0284 **Client:**
Project: North Region Waste Water
 Location: B-2

Remarks:
 F.M.=0.02

Nodarse & Associates, Inc.
Winter Park, FL

Plate



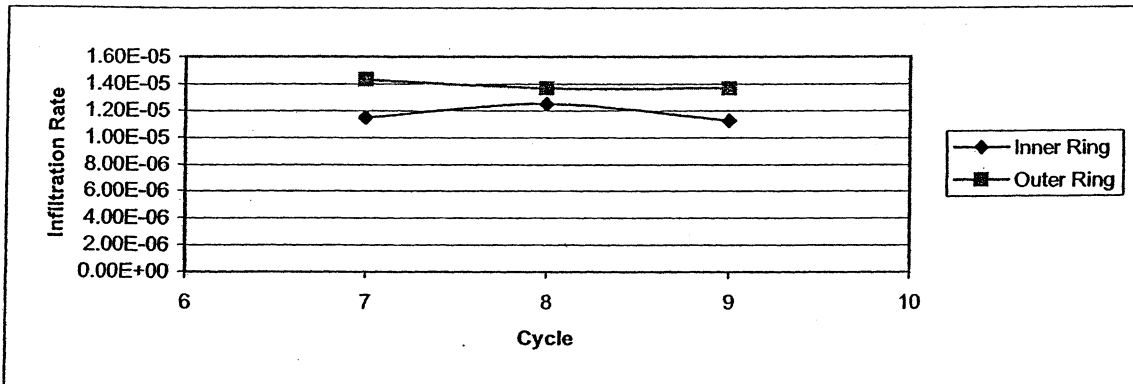
**Double Ring
Field Permeability Test**

Project Name: North Regional Wastewater Treatment Plant
Project Number: 07-015
Test Date: 10/18/07
Test ID: DRI-2
Location Description: Per Plan
Test Depth: 1.5 ft

Inner Ring Diameter: 12 in 0.3048 m
 Outer Ring Diameter: 24 in 0.6096 m

Area Outer Ring: 3.14 ft² 0.00203 m²
 Area Inner Ring: 0.79 ft² 0.00051 m²
 Net Outer Ring Area: 2.36 ft² 0.00152 m²

Cycle	Inner Ring			Outer Ring		
	ElapTime (sec)	Vol Used (in ³)	Infiltration Rate (ft/sec)	ElapTime (sec)	Vol Used (in ³)	Infiltration Rate (ft/sec)
7	1800	28.07	1.15E-05	1800	104.96	1.43E-05
8	3600	61.02	1.25E-05	3600	200.16	1.37E-05
9	3600	54.92	1.12E-05	3600	200.16	1.37E-05
		Avg	1.17E-05		Avg	1.39E-05



	Inner Ring	Outer Ring	
Hydraulic Conductivity:	0.51	0.60	in/hr



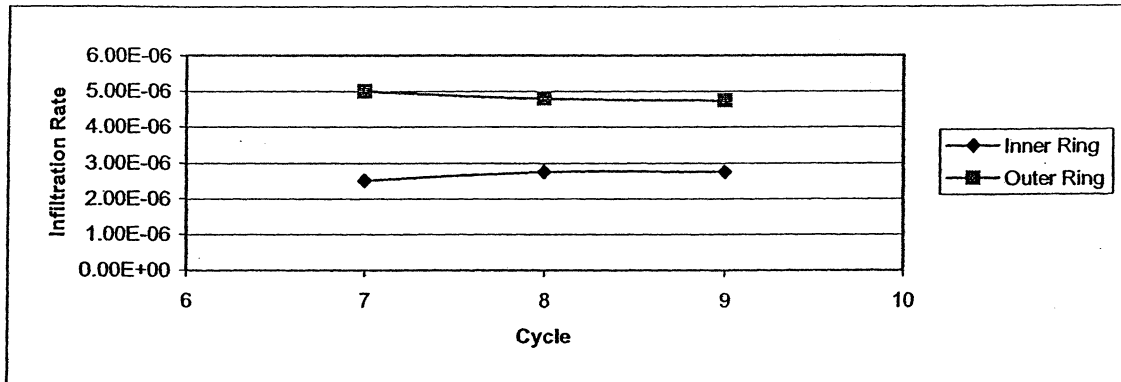
**Double Ring
Field Permeability Test**

Project Name: North Regional Wastewater Treatment Plant
Project Number: 07-015
Test Date: 10/18/07
Test ID: DRI-1
Location Description: Per Plan
Test Depth: 1.5 ft

Inner Ring Diameter: 12 in 0.3048 m
 Outer Ring Diameter: 24 in 0.6096 m

Area Outer Ring: 3.14 ft² 0.00203 m²
 Area Inner Ring: 0.79 ft² 0.00051 m²
 Net Outer Ring Area: 2.36 ft² 0.00152 m²

Cycle	Inner Ring			Outer Ring		
	ElapTime (sec)	Vol Used (in ³)	Infiltration Rate (ft/sec)	ElapTime (sec)	Vol Used (in ³)	Infiltration Rate (ft/sec)
7	1800	6.10	2.50E-06	1800	36.61	5.00E-06
8	3600	13.43	2.75E-06	3600	70.18	4.79E-06
9	3600	13.43	2.75E-06	3600	69.57	4.75E-06
		Avg	2.66E-06		Avg	4.84E-06



	Inner Ring	Outer Ring	
Hydraulic Conductivity:	0.12	0.21	in/hr

DOUBLE RING INFILTRATION TEST

CLIENT: URS
 PROJECT: North Region Wastewater
 JOB NUMBER: _____
 LOCATION: _____

DRI NUMBER: DRI-1
 DATE PERFORMED: 10-18-07
 TECHNICIAN: J. Randolph

II. INSTRUCTIONS

- (1) Excavate to the test depth and clear off all loose soil and surface vegetation: TEST DEPTH 15'
- (2) Drive outer ring 6-inches into ground at test depth, check ring for verticality
- (3) Drive inner ring 2-inches into ground at test depth, check ring for verticality
- (4) Tamp down soil inside and outside of rings to approximately natural conditions

III. TEST PROCEDURE

- (1) Use Burlap to cover where water will be poured into the rings.
- (2) Fill both rings with clean water to equal height above exposed ground surface (between 1 and 6 inches)
- (3) After filling to this level and holding for approximately 15 minutes, record quantity of water added to the inner ring and to the area between the rings to maintain the water level at the established height.
 - (a) Record the water volume at the time intervals of 15-minutes for the first hour, 30 minute intervals for the second hour and then at 60 minute intervals until the test is completed.
 - (b) Perform test until the infiltration results for the rings are the same rates for a minimum of 3 time intervals.
 - (c) Volume used in outer ring should be approximately three times the volume used in the inner ring. If test results vary widely from this ratio, reset rings a few feet away and repeat test.

RING SET: A B C				INNER RING - 12" DIAMETER			OUTER RING <u>24"</u> DIAMETER		
CYCLE	TIME START	TIME END	TIME SEC.	VOL. ADDED (ml)	VOL. ADDED (in)	INFILTRATION RATE	VOL. ADDED (ml)	VOL. ADDED (in)	INFILTRATION RATE
1	00:05	00:05		Saturated					
2	00:15	00:30	15	80			430		
3	00:30	00:45	15	20			390		
4	00:45	1:00	15	40			400		
5	1:00	1:15	15	40			380		
6	1:15	1:45	30	120			640		
7	1:45	2:15	30	100			600		
8	2:15	3:15	1:00	220			1150		
9	3:15	4:15	1:00	220			1140		



DOUBLE RING INFILTRATION TEST

CLIENT: URS DRI NUMBER: DRI-2
 PROJECT: North Region Waste Water DATE PERFORMED: 10-18-07
 JOB NUMBER: _____ TECHNICIAN: J. Randolph
 LOCATION: _____

II. INSTRUCTIONS

- (1) Excavate to the test depth and clear off all loose soil and surface vegetation: TEST DEPTH 1.5'
- (2) Drive outer ring 6-inches into ground at test depth, check ring for verticality
- (3) Drive inner ring 2-inches into ground at test depth, check ring for verticality
- (4) Tamp down soil inside and outside of rings to approximately natural conditions

III. TEST PROCEDURE

- (1) Use Burlap to cover where water will be poured into the rings.
- (2) Fill both rings with clean water to equal height above exposed ground surface (between 1 and 6 inches)
- (3) After filling to this level and holding for approximately 15 minutes, record quantity of water added to the inner ring and to the area between the rings to maintain the water level at the established height.
 - (a) Record the water volume at the time intervals of 15-minutes for the first hour, 30 minute intervals for the second hour and then at 60 minute intervals until the test is completed.
 - (b) Perform test until the infiltration results for the rings are the same rates for a minimum of 3 time intervals.
 - (c) Volume used in outer ring should be approximately three times the volume used in the inner ring. If test results vary widely from this ratio, reset rings a few feet away and repeat test.

RING SET: A B C				INNER RING - 12" DIAMETER			OUTER RING <u>24"</u> DIAMETER		
CYCLE	TIME START	TIME END	TIME SEC.	VOL. ADDED (ml)	VOL. ADDED (in)	INFILTRATION RATE	VOL. ADDED (ml)	VOL. ADDED (in)	INFILTRATION RATE
1	00:00	15:00	:15	saturate					
2	15:00	30:00	:15	300			840		
3	30:00	45:00	:15	280			1,080		
4	00:45	1:00	:15	300			960		
5	1:00	1:15	:15	240			900		
6	1:15	1:45	:30	520			1740		
7	1:45	2:15	:30	460			1780		
8	2:15	3:15	:1:00	1,000			3,280		
9	3:15	4:15	:1:00	900			3,280		

SOIL CLASSIFICATION WORKSHEET

Project: NORTH REGIONAL WWTTP

Date: 11-2-7

Project No: 04-07-0284-101A

Tested by: G.N.

Boring No: B-1 Sample No: 2

Depth: 1'5" 3'

Location: _____

Description: _____

USCS: _____ AASHTO: _____

NATURAL MOISTURE

Test Date: _____ Tech: _____

A. Pan Number Y

B. Pan Weight (g) 185.9

C. Weight Wet Soil + Pan (g) 362.1

D. Weight Wet Soil (g) 176.2
C - B

E. Weight Dry Soil + Pan (g) 352.8

F. Weight Dry Soil (g) 166.9
E - B

G. Natural Moisture (%) 5.6%
 $[(D - F) / F] \times 100$

PERCENT FINER THAN #200

Test Date: _____ Tech: _____

H. Pan Number Y

I. Pan Weight (g) 185.9

J. Weight Dry Soil + Pan (Before) (g) 352.8

K. Weight Dry Soil (Before) (g) 166.9
J - I

L. Weight Dry Soil + Pan (After) (g) 343.8

M. Weight Dry Soil (After) (g) 157.9
L - I

N. Percent Passing #200 (%) 5.4%
 $[(K - M) / K] \times 100$

ORGANIC CONTENT

Test Date: _____ Tech: _____

O. Dish Number _____

P. Dish Weight _____

Q. Wt Dry Soil + Dish (Before) _____

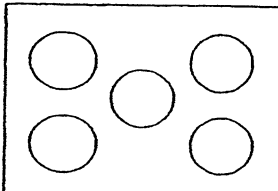
R. Wt Dry Soil (After) _____
Q - P

S. Wt Dry Soil + Dish (After) _____

T. Wt. Dr Soil (After) _____
S - P

U. Organic Content (%) _____
 $[(R - T) / R] \times 100$

Placement in Oven



Front of Oven

SIEVE ANALYSIS

Test Date: _____ Tech: _____

Sieve	Accum. Weight	% Ret.	% Pass
4	Ø	0	100
10	Ø	0	100
20	0.2	0.1 0.2	99.9
40	4.4	2.6	97.4
60	20.6	12.3	87.7
100	81.7	49.0	51.0
200	156.4	93.7	6.3
P	157.9		

Tests Required:

Moist #200 O.C. Sieve LL / PI

SOIL CLASSIFICATION WORKSHEET

Project: North Regional WWTP
 Project No: 04-07-0284-101A
 Boring No: B-1 Sample No: 4
 Location: _____
 Description: _____
 USCS: _____ AASHTO: _____

Date: 11-2-7
 Tested by: G.N.
 Depth: 6'-7.5"

NATURAL MOISTURE

Test Date: _____ Tech: _____

A. Pan Number P
 B. Pan Weight (g) 194.0
 C. Weight Wet Soil + Pan (g) 392.8
 D. Weight Wet Soil (g) 198.8
C - B
 E. Weight Dry Soil + Pan (g) 358.4
 F. Weight Dry Soil (g) 164.4
E - B
 G. Natural Moisture (%) 20.9%
[(D - F) / F] x 100

PERCENT FINER THAN #200

Test Date: _____ Tech: _____

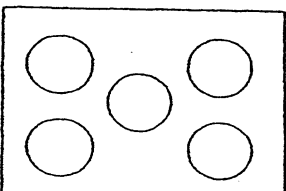
H. Pan Number P
 I. Pan Weight (g) 194.0
 J. Weight Dry Soil + Pan (Before) (g) 358.4
 K. Weight Dry Soil (Before) (g) 164.4
J - I
 L. Weight Dry Soil + Pan (After) (g) 329.7
 M. Weight Dry Soil (After) (g) 135.7
L - I
 N. Percent Passing #200 (%) 17.5%
[(K - M) / K] x 100

ORGANIC CONTENT

Test Date: _____ Tech: _____

O. Dish Number _____
 P. Dish Weight _____
 Q. Wt Dry Soil + Dish (Before) _____
 R. Wt Dry Soil (After) _____
Q - P
 S. Wt Dry Soil + Dish (After) _____
 T. Wt. Dr Soil (After) _____
S - P
 U. Organic Content (%) _____
[(R - T) / R] x 100

Placement in Oven



Front of Oven

SIEVE ANALYSIS

Test Date: _____ Tech: _____

Sieve	Accum. Weight	% Ret.	% Pass
4	0	0	100
10	0.1	0.1	99.9
20	1.0	0.6	99.4
40	5.1	3.1	96.9
60	16.9	10.3	89.7
100	69.1	42.0	58.0
200	134.3	81.7	18.3
P	135.7		

Tests Required:

Moist
 #200
 O.C.
 Sieve
 LL / PI

SOIL CLASSIFICATION WORKSHEET

Project: North Regional WWTP

Date: 11-2-7

Project No: 04-07-0284-101A

Tested by: G.N.

Boring No: B-2 Sample No: 5

Depth: 8.5' - 1.0'

Location: _____

Description: _____

USCS: _____ AASHTO: _____

NATURAL MOISTURE

Test Date: _____ Tech: _____

A. Pan Number W

B. Pan Weight (g) 186.2

C. Weight Wet Soil + Pan (g) 450.3

D. Weight Wet Soil (g)
c - B 264.1

E. Weight Dry Soil + Pan (g) 401.1

F. Weight Dry Soil (g)
E - B 214.9

G. Natural Moisture (%)
 $[(D - F) / F] \times 100$ 22.9%

PERCENT FINER THAN #200

Test Date: _____ Tech: _____

H. Pan Number W

I. Pan Weight (g) 186.2

J. Weight Dry Soil + Pan (Before) (g) 401.1 298.3

K. Weight Dry Soil (Before) (g)
J - I 214.9 112.1

L. Weight Dry Soil + Pan (After) (g) 277.8

M. Weight Dry Soil (After) (g)
L - I 91.6

N. Percent Passing #200 (%)
 $[(K - M) / K] \times 100$ 14.3%

ORGANIC CONTENT

Test Date: _____ Tech: _____

O. Dish Number _____

P. Dish Weight _____

Q. Wt Dry Soil + Dish (Before) _____

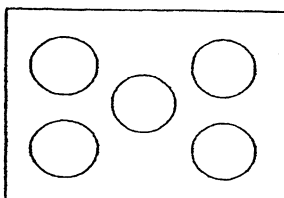
R. Wt Dry Soil (After)
Q - P _____

S. Wt Dry Soil + Dish (After) _____

T. Wt. Dr Soil (After)
S - P _____

U. Organic Content (%)
 $[(R - T) / R] \times 100$ _____

Placement in Oven



Front of Oven

SIEVE ANALYSIS

Sieve	Accum. Weight	% Ret.	% Pass
3/8	6.0	5.4	94.6
4	7.0	6.2	93.8
10	8.2	7.3	92.7
20	9.2	8.2	91.8
40	12.4	11.1	88.9
60	19.6	17.5	82.5
100	47.4	42.3	57.7
200	90.7	80.9	19.1
P	91.5		

ATT.
NOT
Plasti
Wood
Not
Roll

Tests Required:

Moist #200 O.C. Sieve L / FI

SOIL CLASSIFICATION WORKSHEET

Project: North Regional WWTTP

Date: 11-2-7

Project No: 04-07-0284-101A

Tested by: G.N.

Boring No: B-3 Sample No: 7

Depth: 18.5" - 20'

Location: _____

Description: _____

USCS: _____ AASHTO: _____

NATURAL MOISTURE

Test Date: _____ Tech: _____

A. Pan Number U

B. Pan Weight (g) 191.5

C. Weight Wet Soil + Pan (g) 371.9

D. Weight Wet Soil (g) 180.4
C - B

E. Weight Dry Soil + Pan (g) 332.4

F. Weight Dry Soil (g) 140.9
E - B

G. Natural Moisture (%) 28.0%
 $[(D - F) / F] \times 100$

PERCENT FINER THAN #200

Test Date: _____ Tech: _____

H. Pan Number U

I. Pan Weight (g) 191.5

J. Weight Dry Soil + Pan (Before) (g) 332.4

K. Weight Dry Soil (Before) (g) 140.9
J - I

L. Weight Dry Soil + Pan (After) (g) 293.8

M. Weight Dry Soil (After) (g) 102.3
L - I

N. Percent Passing #200 (%) 27.4%
 $[(K - M) / K] \times 100$

ORGANIC CONTENT

Test Date: _____ Tech: _____

O. Dish Number _____

P. Dish Weight _____

Q. Wt Dry Soil + Dish (Before) _____

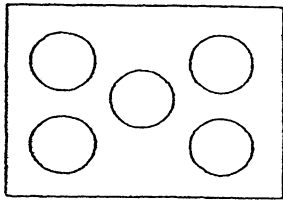
R. Wt Dry Soil (After) _____
Q - P

S. Wt Dry Soil + Dish (After) _____

T. Wt. Dr Soil (After) _____
S - P

U. Organic Content (%) _____
 $[(R - T) / R] \times 100$

Placement in Oven



Front of Oven

SIEVE ANALYSIS

Sieve	Accum. Weight	% Ret.	% Pass
4	Ø	0	100
10	Ø	0	100
20	0.2	0.1	99.9
40	0.5	0.4	99.6
60	1.5	1.1	98.9
100	39.7	28.2	71.8
200	101.6	72.1	27.9
P	102.3		

Tests Required:

- Moist
 #200
 O.C.
 Sieve
 LL / PI

SOIL CLASSIFICATION WORKSHEET

Project: North Regional WOTP

Date: 11-2-7

Project No: 04-07-0284-101A

Tested by: G.N.

Boring No: B-5 Sample No: 2

Depth: 5" - 2'

Location: _____

Description: _____

USCS: _____

AASHTO: _____

NATURAL MOISTURE

Test Date: _____ Tech: _____

A. Pan Number T

B. Pan Weight (g) 192.9

C. Weight Wet Soil + Pan (g) 400.1

D. Weight Wet Soil (g) 207.2
C - B

E. Weight Dry Soil + Pan (g) 381.8

F. Weight Dry Soil (g) 188.9
E - B

G. Natural Moisture (%) 9.7%
 $[(D - F) / F] \times 100$

PERCENT FINER THAN #200

Test Date: _____ Tech: _____

H. Pan Number T

I. Pan Weight (g) 192.9

J. Weight Dry Soil + Pan (Before) (g) 381.8

K. Weight Dry Soil (Before) (g) 188.9
J - I

L. Weight Dry Soil + Pan (After) (g) 357.1

M. Weight Dry Soil (After) (g) 164.2
L - I

N. Percent Passing #200 (%) 13.1%
 $[(K - M) / K] \times 100$

ORGANIC CONTENT

Test Date: _____ Tech: _____

O. Dish Number _____

P. Dish Weight _____

Q. Wt Dry Soil + Dish (Before) _____

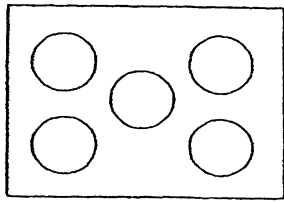
R. Wt Dry Soil (After) _____
Q - P

S. Wt Dry Soil + Dish (After) _____

T. Wt. Dr Soil (After) _____
S - P

U. Organic Content (%) _____
 $[(R - T) / R] \times 100$

Placement in Oven



Front of Oven

SIEVE ANALYSIS

Sieve	Accum. Weight	% Ret.	% Pass
4	∅	0	100
10	0.2	0.1	99.9
20	1.3	0.7	99.3
40	5.2	2.8	97.2
60	18.2	9.6	90.4
100	82.5	43.7	56.3
200	162.0	85.8	14.2
P	164.2		

Tests Required:

Moist
 #200
 G.C.
 Sieve
 LL / PI

APPENDIX C

Bearing Capacity and Settlement Estimations

BEARING CAPACITY ON LAYERED SOILS - SAND OVER CLAY

FOUNDATION ANALYSIS AND DESIGN (BOWLES 5th Edition, pg 254)

PROJECT NAME : Influent Structure Foundation

LOCATION : North Regional Wastewater Treatment Plant, Manatee County Florida

STATION : North Regional Wastewater Treatment Plant

BEARING CAPACITY OF CLAY LAYER

$B = 6.0$ ft
 $L = 14.0$ ft
 $D = 1.5$ ft
 $Z = 4.0$ ft Depth of Water from Ground surface
 $e_B = 0.0$ ft
 $e_L = 0.0$ ft
 $\theta = 0^\circ$ Excentricity
 $\theta = 0^\circ$ Inclination
 $\phi_{\text{clay}} = 0^\circ$
 $C_{\text{clay}} = 500$ psf $N_{\text{AVG}} = 4$ (From SPT Boring A3-D1)
 $\gamma_{\text{clay}} = 105$ pcf

FROM CLAY PROPERTIES

$N_\phi = 1.00$
 $N_q = 1.00$
 $N_c = 5.14$
 $N_\gamma = 0.00$

SHAPE & ECCENTRICITY FACTORS

$B' = 6$ $L' = 14$
 $\lambda_{cs} = 1.09$ $\lambda_{qs} = 1.00$
 $\lambda_{\gamma s} = 1.00$

DEPTH FACTORS

$\lambda_{cd} = 2.18$ $\lambda_{qd} = 1.00$
 $\lambda_{\gamma d} = 1.00$

INCLINATION FACTORS

$\lambda_{ci} = 1.00$ $\lambda_{qi} = 1.00$
 $\lambda_{\gamma i} = 1.00$

BEARING CAPACITY OF SAND LAYER

$H = 5.2$ ft Depth of Footing Influence
 $H_{\text{sand}} = 34.0$ ft Thickness of Sand below Footing
 $\gamma_{\text{sand}} = 115$ pcf
 $\gamma'_{\text{sand}} = 52.6$ pcf
 $\gamma_{\text{Effect}} = 57.2$ pcf
 $\phi_{\text{sand}} = 30^\circ$
 $C_{\text{sand}} = 0$ psf
 $K_o = 0.50$
 $F.S. = 3.0$

FROM SAND PROPERTIES

$N_\phi = 3.00$
 $N_q = 18.40$
 $N_c = 30.14$
 $N_\gamma = 15.67$

SHAPE & ECCENTRICITY FACTORS

$B' = 6$ $L' = 14$
 $\lambda_{cs} = 1.26$ $\lambda_{qs} = 1.13$
 $\lambda_{\gamma s} = 1.13$

DEPTH FACTORS

$\lambda_{cd} = 1.09$ $\lambda_{qd} = 1.04$
 $\lambda_{\gamma d} = 1.04$

INCLINATION FACTORS

$\lambda_{ci} = 1.00$ $\lambda_{qi} = 1.00$
 $\lambda_{\gamma i} = 1.00$

CORRECTION FOR LARGE FOOTING AND MATS

$\gamma_f = 1.00$

$Q_{ult, \text{Clay}} = 8037$ psf

$Q_{ult, \text{Sand}} = 8088$ psf

$Q_{ult} = 13387$ psf

DEPTH OF FOOTING INFLUENCE DOES NOT EXCEED SAND/GRAVEL THICKNESS
 USE BEARING CAPACITY FROM SAND/GRAVEL LAYER

$Q_u = 8088$ psf

$Q_{all} = 2696$ psf

$Q_{\text{Net all}} = 2638$ psf

$F_{\text{Net all}} = 222$ kips

Footings 6x14

*⇒ USE 2.5 KSF Allowable
 18" Below Ground Surface
 6x14 and 8x14*

BEARING CAPACITY ON LAYERED SOILS - SAND OVER CLAY

FOUNDATION ANALYSIS AND DESIGN (BOWLES 5th Edition, pg 254)

PROJECT NAME : Influent Structure Foundation

LOCATION : North Regional Wastewater Treatment Plant, Manatee County Florida

STATION : North Regional Wastewater Treatment Plant

BEARING CAPACITY OF CLAY LAYER

B = 6.0 ft
 L = 14.0 ft
 D = 1.5 ft
 Z = 4.0 ft Depth of Water from Ground surface
 $e_g = 0.0$ ft Exentricity
 $e_L = 0.0$ ft Exentricity
 $\theta = 0^\circ$ Inclination
 $\phi_{clay} = 0^\circ$
 $C_{clay} = 500$ psf $N_{AVG} = 4$ (From SPT Boring A3-D1)
 $\gamma_{clay} = 105$ pcf

FROM CLAY PROPERTIES

$N_\phi = 1.00$
 $N_q = 1.00$
 $N_c = 5.14$
 $N_\gamma = 0.00$

SHAPE & ECCENTRICITY FACTORS

$B' = 6$ $L' = 14$
 $\lambda_{cs} = 1.09$ $\lambda_{qs} = 1.00$
 $\lambda_{ys} = 1.00$

DEPTH FACTORS

$\lambda_{cd} = 2.05$ $\lambda_{qd} = 1.00$
 $\lambda_{yd} = 1.00$

INCLINATION FACTORS

$\lambda_{ci} = 1.00$ $\lambda_{qi} = 1.00$
 $\lambda_{yi} = 1.00$

BEARING CAPACITY OF SAND LAYER

H = 5.2 ft Depth of Footing Influence
 $H_{sand} = 30.0$ ft Thickness of Sand below Footing
 $\gamma_{sand} = 110$ pcf
 $\gamma'_{sand} = 47.6$ pcf
 $\gamma_{Effect} = 52.8$ pcf
 $\phi_{sand} = 30^\circ$
 $C_{sand} = 0$ psf
 $K_o = 0.50$
 $F.S. = 3.0$

silty clayey sand layer

FROM SAND PROPERTIES

$N_\phi = 3.00$
 $N_q = 18.40$
 $N_c = 30.14$
 $N_\gamma = 15.67$

SHAPE & ECCENTRICITY FACTORS

$B' = 6$ $L' = 14$
 $\lambda_{cs} = 1.26$ $\lambda_{qs} = 1.13$
 $\lambda_{ys} = 1.13$

DEPTH FACTORS

$\lambda_{cd} = 1.09$ $\lambda_{qd} = 1.04$
 $\lambda_{yd} = 1.04$

INCLINATION FACTORS

$\lambda_{ci} = 1.00$ $\lambda_{qi} = 1.00$
 $\lambda_{yi} = 1.00$

CORRECTION FOR LARGE FOOTING AND MATS

$r_\gamma = 1.00$

$Q_{ult,clay} = 7304$ psf

$Q_{ult,sand} = 7648$ psf

$Q_{ult} = 11251$ psf

**DEPTH OF FOOTING INFLUENCE DOES NOT EXCEED SAND/GRAVEL THICKNESS
USE BEARING CAPACITY FROM SAND/GRAVEL LAYER**

$Q_u = 7648$ psf

$Q_{all} = 2549$ psf

$Q_{Net all} = 2494$ psf

$F_{Net all} = 210$ kips

Footings 6x14

BEARING CAPACITY ON LAYERED SOILS - SAND OVER CLAY

FOUNDATION ANALYSIS AND DESIGN (BOWLES 5th Edition, pg 254)

PROJECT NAME : Influent Structure Foundation

LOCATION : North Regional Wastewater Treatment Plant, Manatee County Florida

STATION : North Regional Wastewater Treatment Plant

BEARING CAPACITY OF CLAY LAYER

$B = 8.0 \text{ ft}$
 $L = 14.0 \text{ ft}$
 $D = 1.5 \text{ ft}$
 $Z = 4.0 \text{ ft}$ Depth of Water from Ground surface
 $e_B = 0.0 \text{ ft}$
 $e_L = 0.0 \text{ ft}$ } Exentricity
 $\theta = 0^\circ$ } Inclination
 $\phi_{\text{clay}} = 0^\circ$
 $C_{\text{clay}} = 0 \text{ psf}$
 $\gamma_{\text{clay}} = 0 \text{ pcf}$

FROM CLAY PROPERTIES

$N\phi = 1.00$
 $Nq = 1.00$
 $NC = 5.14$
 $N\gamma = 0.00$

SHAPE & ECCENTRICITY FACTORS

$B' = 8$ $L' = 14$
 $\lambda_{cs} = 1.11$ $\lambda_{\gamma s} = 1.00$ $\lambda_{qs} = 1.00$

DEPTH FACTORS

$\lambda_{cd} = 1.79$ $\lambda_{\gamma d} = 1.00$ $\lambda_{qd} = 1.00$

INCLINATION FACTORS

$\lambda_{ci} = 1.00$ $\lambda_{\gamma i} = 1.00$ $\lambda_{qi} = 1.00$

BEARING CAPACITY OF SAND LAYER

$H = 6.9 \text{ ft}$ Depth of Footing Influence
 $H_{\text{sand}} = 30.0 \text{ ft}$ Thickness of Sand below Footing
 $\gamma_{\text{sand}} = 110 \text{ pcf}$
 $\gamma'_{\text{sand}} = 47.6 \text{ pcf}$
 $\gamma_{\text{Effect}} = 52.8 \text{ pcf}$
 $\phi_{\text{sand}} = 30^\circ$
 $C_{\text{sand}} = 0 \text{ psf}$
 $K_o = 0.50$
 $F.S. = 3.0$

Silty clayey sand layer

FROM SAND PROPERTIES

$N\phi = 3.00$
 $Nq = 18.40$
 $Nc = 30.14$
 $N\gamma = 15.67$

SHAPE & ECCENTRICITY FACTORS

$B' = 8$ $L' = 14$
 $\lambda_{cs} = 1.34$ $\lambda_{\gamma s} = 1.17$ $\lambda_{qs} = 1.17$

DEPTH FACTORS

$\lambda_{cd} = 1.06$ $\lambda_{\gamma d} = 1.03$ $\lambda_{qd} = 1.03$

INCLINATION FACTORS

$\lambda_{ci} = 1.00$ $\lambda_{\gamma i} = 1.00$ $\lambda_{qi} = 1.00$

CORRECTION FOR LARGE FOOTING AND MATS

$r_\gamma = 0.97$

$Q_{ult, \text{Clay}} = 1584 \text{ psf}$

$Q_{ult, \text{Sand}} = 8600 \text{ psf}$

$Q_{ult} = 4840 \text{ psf}$

**DEPTH OF FOOTING INFLUENCE DOES NOT EXCEED SAND/GRAVEL THICKNESS
USE BEARING CAPACITY FROM SAND/GRAVEL LAYER**

$Q_u = 8600 \text{ psf}$

$Q_{all} = 2867 \text{ psf}$

$Q_{\text{Net all}} = 2812 \text{ psf}$

$F_{\text{Net all}} = 315 \text{ kips}$

Footing = 8x14

SETTLEMENT ANALYSES USING SCHMERTMANN METHOD

PROJECT TITLE: NRWTP - Influent Structure
 BORING LOCATION: B-2
 BY: URS Corporation
 LOCATION: Proposed Influent Structure

JOB NUMBER: 12004319
 DATE: 5-Nov-07

FILL HEIGHT (H) 0.0 FT.
 BASE WIDTH (B) 8.0 FT.
 BASE LENGTH (L) 14.0 FT.
 EXCAVATION DEPTH (d) 1.5 FT.
 APPLIED LOAD (INPUT TO OVERRIDE) 1.25 TSF
 WATER TABLE DEPTH (w) 4.0 FT.
 INFLUENT PEAK DEPTH 4.7 FT.
 EFF. OVERBURDEN @ Peak 0.2367 TSF
 MAX. INF. FACTOR @ Peak 0.7221 TSF
 INFLUENT DEPTH RATIO 1.8

FILL UNIT WEIGHT 115.0 PSF
 SOIL UNIT WEIGHT 110.0 PSF
 SOIL TYPE 1
 USE 1 FOR SANDS, SILT, CLAY MIXTURE
 USE 2 FOR SLIGHTLY SILTY TO SILTY SANDS
 USE 3 FOR OVER- CONSOLIDATED SANDS
 USE 4 FOR SANDS, SANDS WITH GRAVEL

Surcharge 0.0 PSF

DEPTH	SOIL TYPE	BLOW COUNT	D/B RATIO	UNIT DEPTH	UNIT INFLUENCE	CONE RESIST.	EQUIV. MODULUS	UNIT SETTLE.
1.0	3	22.0000	0.1250	1.0	0.2943	110.0	275.0	0.0011
3.0	3	32.0000	0.3750	2.0	0.4257	160.0	400.0	0.0021
5.0	3	18.0000	0.6250	2.0	0.5501	90.0	225.0	0.0049
7.5	1	7.0000	0.9375	2.5	0.6583	14.0	35.0	0.0470
10.0	1	17.0000	1.2500	2.5	0.5596	34.0	85.0	0.0165
15.0	1	9.0000	1.8750	5.0	0.2588	18.0	45.0	0.0288
20.0	1	20.0000	2.5000	5.0	0.0000	40.0	100.0	0.0000
25.0	1	9.0000	3.1250	5.0	0.0000	18.0	45.0	0.0000
30.0	1	26.0000	3.7500	5.0	0.0000	52.0	130.0	0.0000
35.0	1	9.0000	4.3750	5.0	0.0000	18.0	45.0	0.0000
40.0	4	100.0000	5.0000	5.0	0.0000	600.0	1500.0	0.0000

↑
Marginal Soil

8x14' Foot. f

TOTAL SETTLEMENT

SUM UNIT SETTLEMENT
 1.50 INCH

0.1003

NOTES

1. FILL IN THE INFORMATION REQUIRED INSIDE THE BOXES OUTLINED

SETTLEMENT ANALYSES USING SCHMERTMANN METHOD

PROJECT TITLE: NRWTP - Influent Structure
 BORING LOCATION: B-1

JOB NUMBER: 12004319
 DATE: 5-Nov-07

BY: URS Corporation

LOCATION: Proposed Influent Structure

FILL HEIGHT (H)	0.0	FT.
BASE WIDTH (B)	6.0	FT.
BASE LENGTH (L)	14.0	FT.
EXCAVATION DEPTH (d)	1.5	FT.
APPLIED LOAD (INPUT TO OVERRIDE)	1.25	TSF
WATER TABLE DEPTH (w)	4.0	FT.
INFLUENT PEAK DEPTH	3.7	FT.
EFF. OVERBURDEN @ Peak	0.2129	TSF
MAX. INF. FACTOR @ Peak	0.7342	TSF
INFLUENT DEPTH RATIO	2.3	

FILL UNIT WEIGHT	115.0	PSF
SOIL UNIT WEIGHT	110.0	PSF
SOIL TYPE	1	

USE 1 FOR SANDS, SILT, CLAY MIXTURE
 USE 2 FOR SLIGHTLY SILTY TO SILTY SANDS
 USE 3 FOR OVER- CONSOLIDATED SANDS
 USE 4 FOR SANDS, SANDS WITH GRAVEL

Surcharge 0.0 PSF

DEPTH	SOIL TYPE	BLOW COUNT	D/B RATIO	UNIT DEPTH	UNIT INFLUENCE	CONE RESIST.	EQUIV. MODULUS	UNIT SETTLE.
1.0	3	36.0000	0.1667	1.0	0.2943	180.0	450.0	0.0007
3.0	3	38.0000	0.5000	2.0	0.5294	190.0	475.0	0.0022
5.0	3	16.0000	0.8333	2.0	0.6279	80.0	200.0	0.0063
7.5	1	9.0000	1.2500	2.5	0.5547	18.0	45.0	0.0308
10.0	1	8.0000	1.6667	2.5	0.3508	16.0	40.0	0.0219
15.0	1	10.0000	2.5000	5.0	0.0000	20.0	50.0	0.0000
20.0	1	14.0000	3.3333	5.0	0.0000	28.0	70.0	0.0000
25.0	1	14.0000	4.1667	5.0	0.0000	28.0	70.0	0.0000
30.0	1	13.0000	5.0000	5.0	0.0000	26.0	65.0	0.0000
35.0	1	30.0000	5.8333	5.0	0.0000	60.0	150.0	0.0000
40.0	4	55.0000	6.6667	5.0	0.0000	330.0	825.0	0.0000

TOTAL SETTLEMENT

SUM UNIT SETTLEMENT 0.0619
0.93 INCH

NOTES

1. FILL IN THE INFORMATION REQUIRED INSIDE THE BOXES OUTLINED

SETTLEMENT ANALYSES USING SCHMERTMANN METHOD

PROJECT TITLE: NRWTP - Influent Structure
 BORING LOCATION: B-2
 BY: URS Corporation
 LOCATION: Proposed Influent Structure

JOB NUMBER: 12004319
 DATE: 5-Nov-07

FILL HEIGHT (H) 0.0 FT.
BASE WIDTH (B) 6.0 FT.
BASE LENGTH (L) 14.0 FT.
EXCAVATION DEPTH (d) 1.5 FT.
APPLIED LOAD (INPUT TO OVERRIDE) 1.25 TSF
WATER TABLE DEPTH (w) 4.0 FT.
 INFLUENT PEAK DEPTH 3.7 FT
 EFF. OVERBURDEN@ Peak 0.2129 TSF
 MAX. INF. FACTOR @ Peak 0.7342 TSF
 INFLUENT DEPTH RATIO 2.3

FILL UNIT WEIGHT 115.0 PSF
SOIL UNIT WEIGHT 110.0 PSF
SOIL TYPE 1
 USE 1 FOR SANDS, SILT, CLAY MIXTURE
 USE 2 FOR SLIGHTLY SILTY TO SILTY SANDS
 USE 3 FOR OVER- CONSOLIDATED SANDS
 USE 4 FOR SANDS, SANDS WITH GRAVEL

Surcharge 0.0 PSF

DEPTH	SOIL TYPE	BLOW COUNT	D/B RATIO	UNIT DEPTH	UNIT INFLUENCE	CONE RESIST.	EQUIV. MODULUS	UNIT SETTLE.
1.0	3	22.0000	0.1667	1.0	0.2943	110.0	275.0	0.0011
3.0	3	32.0000	0.5000	2.0	0.5294	160.0	400.0	0.0026
5.0	3	18.0000	0.8333	2.0	0.6279	90.0	225.0	0.0056
7.5	1	7.0000	1.2500	2.5	0.5547	14.0	35.0	0.0396
10.0	1	17.0000	1.6667	2.5	0.3508	34.0	85.0	0.0103
15.0	1	9.0000	2.5000	5.0	0.0000	18.0	45.0	0.0000
20.0	1	20.0000	3.3333	5.0	0.0000	40.0	100.0	0.0000
25.0	1	9.0000	4.1667	5.0	0.0000	18.0	45.0	0.0000
30.0	1	26.0000	5.0000	5.0	0.0000	52.0	130.0	0.0000
35.0	1	9.0000	5.8333	5.0	0.0000	18.0	45.0	0.0000
40.0	4	100.0000	6.6667	5.0	0.0000	600.0	1500.0	0.0000

TOTAL SETTLEMENT

SUM UNIT SETTLEMENT 0.0592
0.89 INCH

NOTES

1. FILL IN THE INFORMATION REQUIRED INSIDE THE BOXES OUTLINED

SETTLEMENT ANALYSES USING SCHMERTMANN METHOD

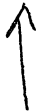
PROJECT TITLE: NRWTP - Influent Structure
 BORING LOCATION: B-1
 BY: URS Corporation
 LOCATION: Proposed Influent Structure

JOB NUMBER: 12004319
 DATE: 5-Nov-07

FILL HEIGHT (H) 0.0 FT.
 BASE WIDTH (B) 8.0 FT.
 BASE LENGTH (L) 14.0 FT.
 EXCAVATION DEPTH (d) 1.5 FT.
 APPLIED LOAD (INPUT TO OVERRIDE) 1.25 TSF
 WATER TABLE DEPTH (w) 4.0 FT.
 INFLUENT PEAK DEPTH 4.7 FT.
 EFF. OVERBURDEN @ Peak 0.2367 TSF
 MAX. INF. FACTOR @ Peak 0.7221 TSF
 INFLUENT DEPTH RATIO 1.8

FILL UNIT WEIGHT 115.0 PSF
 SOIL UNIT WEIGHT 110.0 PSF
 SOIL TYPE 1
 USE 1 FOR SANDS, SILT, CLAY MIXTURE
 USE 2 FOR SLIGHTLY SILTY TO SILTY SANDS
 USE 3 FOR OVER- CONSOLIDATED SANDS
 USE 4 FOR SANDS, SANDS WITH GRAVEL
 Surcharge 0.0 PSF

DEPTH	SOIL TYPE	BLOW COUNT	D/B RATIO	UNIT DEPTH	UNIT INFLUENCE	CONE RESIST.	EQUIV. MODULUS	UNIT SETTLE.
1.0	3	36.0000	0.1250	1.0	0.2943	180.0	450.0	0.0007
3.0	3	38.0000	0.3750	2.0	0.4257	190.0	475.0	0.0018
5.0	3	16.0000	0.6250	2.0	0.5501	80.0	200.0	0.0055
7.5	3	9.0000	0.9375	2.5	0.6583	45.0	112.5	0.0146
10.0	3	8.0000	1.2500	2.5	0.5596	40.0	100.0	0.0140
15.0	3	10.0000	1.8750	5.0	0.2588	50.0	125.0	0.0104
20.0	3	14.0000	2.5000	5.0	0.0000	70.0	175.0	0.0000
25.0	3	14.0000	3.1250	5.0	0.0000	70.0	175.0	0.0000
30.0	3	13.0000	3.7500	5.0	0.0000	65.0	162.5	0.0000
35.0	3	30.0000	4.3750	5.0	0.0000	150.0	375.0	0.0000
40.0	4	55.0000	5.0000	5.0	0.0000	330.0	825.0	0.0000



BEST possible sub-soil.

*8' x 14' footing @ 18" below
 ground surface. $q_{all} = 2.5 \text{ KSF}$*

SUM UNIT SETTLEMENT 0.0469

TOTAL SETTLEMENT

0.70 INCH

NOTES

1. FILL IN THE INFORMATION REQUIRED INSIDE THE BOXES OUTLINED

SETTLEMENT ANALYSES USING SCHMERTMANN METHOD

PROJECT TITLE: NRWTP - Influent Structure
 BORING LOCATION: B-1
 BY: URS Corporation
 LOCATION: Proposed Influent Structure

JOB NUMBER: 12004319
 DATE: 5-Nov-07

FILL HEIGHT (H) 0.0 FT.
BASE WIDTH (B) 22.5 FT.
BASE LENGTH (L) 22.5 FT.
EXCAVATION DEPTH (d) 1.5 FT.
APPLIED LOAD (INPUT TO OVERRIDE) 0.75 TSF
WATER TABLE DEPTH (w) 4.0 FT.
 INFLUENT PEAK DEPTH 12.4 FT
 EFF. OVERBURDEN @ Peak 0.4193 TSF
 MAX. INF. FACTOR @ Peak 0.6262 TSF
 INFLUENT DEPTH RATIO 1.0

FILL UNIT WEIGHT 115.0 PSF
SOIL UNIT WEIGHT 110.0 PSF
SOIL TYPE 1
 USE 1 FOR SANDS, SILT, CLAY MIXTURE
 USE 2 FOR SLIGHTLY SILTY TO SILTY SANDS
 USE 3 FOR OVER- CONSOLIDATED SANDS
 USE 4 FOR SANDS, SANDS WITH GRAVEL
Surcharge 0.0 PSF

DEPTH	SOIL TYPE	BLOW COUNT	D/B RATIO	UNIT DEPTH	UNIT INFLUENCE	CONE RESIST.	EQUIV. MODULUS	UNIT SETTLE.
1.0	3	36.0000	0.0444	1.0	0.2943	180.0	450.0	0.0007
3.0	3	38.0000	0.1333	2.0	0.2403	190.0	475.0	0.0010
5.0	3	16.0000	0.2222	2.0	0.3339	80.0	200.0	0.0033
7.5	1	9.0000	0.3333	2.5	0.4508	18.0	45.0	0.0250
10.0	1	8.0000	0.4444	2.5	0.5677	16.0	40.0	0.0355
15.0	1	10.0000	0.6667	5.0	0.5566	20.0	50.0	0.0557
20.0	1	14.0000	0.8889	5.0	0.4638	28.0	70.0	0.0331
25.0	1	14.0000	1.1111	5.0	0.3711	28.0	70.0	0.0265
30.0	1	13.0000	1.3333	5.0	0.2783	26.0	65.0	0.0214
35.0	1	30.0000	1.5556	5.0	0.1855	60.0	150.0	0.0062
40.0	4	55.0000	1.7778	5.0	0.0928	330.0	825.0	0.0006

22.5' x 22.5' MAT
 @ 1.5 KSF
 b = 1.88 inches

TOTAL SETTLEMENT SUM UNIT SETTLEMENT 0.2090
1.88 INCH

NOTES

1. FILL IN THE INFORMATION REQUIRED INSIDE THE BOXES OUTLINED

⇒ USE DEEP FOUNDATION
 + ANCHOR CAST PILES : 14" φ → 16" φ X 35' - 40'
 50 → 60 TONS ALLOW. CAP.
 + PRECAST PRESTRESS 14" φ PILE → 50 → 60 TONS

SETTLEMENT ANALYSES USING SCHMERTMANN METHOD

PROJECT TITLE: NRWTP - Influent Structure
 BORING LOCATION: B-1
 BY: URS Corporation
 LOCATION: Proposed Influent Structure

JOB NUMBER: 12004319
 DATE: 5-Nov-07

FILL HEIGHT (H) 0.0 FT.
BASE WIDTH (B) 22.5 FT.
BASE LENGTH (L) 22.5 FT.
EXCAVATION DEPTH (d) 1.5 FT.
APPLIED LOAD (INPUT TO OVERRIDE) 1.00 TSF
WATER TABLE DEPTH (w) 4.0 FT.
 INFLUENT PEAK DEPTH 12.4 FT
 EFF. OVERBURDEN @ Peak 0.4193 TSF
 MAX. INF. FACTOR @ Peak 0.6479 TSF
 INFLUENT DEPTH RATIO 1.0

FILL UNIT WEIGHT 115.0 PSF
SOIL UNIT WEIGHT 110.0 PSF
SOIL TYPE 1

USE 1 FOR SANDS, SILT, CLAY MIXTURE
 USE 2 FOR SLIGHTLY SILTY TO SILTY SANDS
 USE 3 FOR OVER- CONSOLIDATED SANDS
 USE 4 FOR SANDS, SANDS WITH GRAVEL

Surcharge 0.0 PSF

DEPTH	SOIL TYPE	BLOW COUNT	D/B RATIO	UNIT DEPTH	UNIT INFLUENCE	CONE RESIST.	EQUIV. MODULUS	UNIT SETTLE.
1.0	3	36.0000	0.0444	1.0	0.2943	180.0	450.0	0.0007
3.0	3	38.0000	0.1333	2.0	0.2461	190.0	475.0	0.0010
5.0	3	16.0000	0.2222	2.0	0.3435	80.0	200.0	0.0034
7.5	1	9.0000	0.3333	2.5	0.4653	18.0	45.0	0.0258
10.0	1	8.0000	0.4444	2.5	0.5870	16.0	40.0	0.0367
15.0	1	10.0000	0.6667	5.0	0.5759	20.0	50.0	0.0576
20.0	1	14.0000	0.8889	5.0	0.4799	28.0	70.0	0.0343
25.0	1	14.0000	1.1111	5.0	0.3840	28.0	70.0	0.0274
30.0	1	13.0000	1.3333	5.0	0.2880	26.0	65.0	0.0222
35.0	1	30.0000	1.5556	5.0	0.1920	60.0	150.0	0.0064
40.0	4	55.0000	1.7778	5.0	0.0960	330.0	825.0	0.0006

*22.5' x 22.5' MAT
 @ 2.0 Ksf
 Δ = 2.59 inches*

SUM UNIT SETTLEMENT 0.2161

TOTAL SETTLEMENT 2.59 INCH

NOTES

1. FILL IN THE INFORMATION REQUIRED INSIDE THE BOXES OUTLINED

SETTLEMENT ANALYSES USING SCHMERTMANN METHOD

PROJECT TITLE: NRWTP - Influent Structure
 BORING LOCATION: B-1
 BY: URS Corporation
 LOCATION: Proposed Influent Structure

JOB NUMBER: 12004319
 DATE: 5-Nov-07

FILL HEIGHT (H) 0.0 FT.
BASE WIDTH (B) 22.5 FT.
BASE LENGTH (L) 22.5 FT.
EXCAVATION DEPTH (d) 1.5 FT.
APPLIED LOAD (INPUT TO OVERRIDE) 1.25 TSF
WATER TABLE DEPTH (w) 4.0 FT
 INFLUENT PEAK DEPTH 12.4 FT
 EFF. OVERBURDEN @ Peak 0.4193 TSF
 MAX. INF. FACTOR @ Peak 0.6669 TSF
 INFLUENT DEPTH RATIO 1.0

FILL UNIT WEIGHT 115.0 PSF
SOIL UNIT WEIGHT 110.0 PSF
SOIL TYPE 1
 USE 1 FOR SANDS, SILT, CLAY MIXTURE
 USE 2 FOR SLIGHTLY SILTY TO SILTY SANDS
 USE 3 FOR OVER- CONSOLIDATED SANDS
 USE 4 FOR SANDS, SANDS WITH GRAVEL
Surcharge 0.0 PSF

DEPTH	SOIL TYPE	BLOW COUNT	D/B RATIO	UNIT DEPTH	UNIT INFLUENCE	CONE RESIST.	EQUIV. MODULUS	UNIT SETTLE.
1.0	3	36.0000	0.0444	1.0	0.2943	180.0	450.0	0.0007
3.0	3	38.0000	0.1333	2.0	0.2512	190.0	475.0	0.0011
5.0	3	16.0000	0.2222	2.0	0.3519	80.0	200.0	0.0035
7.5	1	9.0000	0.3333	2.5	0.4779	18.0	45.0	0.0266
10.0	1	8.0000	0.4444	2.5	0.6039	16.0	40.0	0.0377
15.0	1	10.0000	0.6667	5.0	0.5928	20.0	50.0	0.0593
20.0	1	14.0000	0.8889	5.0	0.4940	28.0	70.0	0.0353
25.0	1	14.0000	1.1111	5.0	0.3952	28.0	70.0	0.0282
30.0	1	13.0000	1.3333	5.0	0.2964	26.0	65.0	0.0228
35.0	1	30.0000	1.5556	5.0	0.1976	60.0	150.0	0.0066
40.0	4	55.0000	1.7778	5.0	0.0988	330.0	825.0	0.0006

22.5' x 22.5' MAT.
 @ 2.5 KSF.
 $\Delta = 3.33$ inches

TOTAL SETTLEMENT **SUM UNIT SETTLEMENT** 0.2223
3.33 INCH

NOTES
 1. FILL IN THE INFORMATION REQUIRED INSIDE THE BOXES OUTLINED

APPENDIX D

ACIP Pile Capacity Calculations

14-INCH DIAMETER AUGER CAST-IN-PLACE PILES

Boring B-1

Depth	N	Effective Unit weight (PCF)	Beta	Beta C	Corrected Beta	Sigma (PSF)	Unit Side Friction (PSF)	Ultimate Capacity (Kips)	Cummulative Allowable Capacity (Kips)
1	36	52.6	1.250	3.000	1.250	52.6	65.75	0.24	0.12
3	38	52.6	1.266	3.208	1.266	157.8	199.80	1.46	0.85
5	16	52.6	1.198	1.278	1.198	263.0	315.11	2.31	2.01
7.5	9	47.6	1.130	0.678	0.678	382.0	259.06	2.37	3.19
10	8	47.6	1.073	0.572	0.572	501.0	286.73	2.63	4.51
15	10	52.6	0.977	0.651	0.651	764.0	497.69	9.12	9.07
20	14	52.6	0.896	0.837	0.837	1027.0	859.10	15.74	16.94
25	14	52.6	0.825	0.770	0.770	1290.0	993.30	18.20	26.04
30	13	52.6	0.761	0.659	0.659	1553.0	1023.68	18.76	35.42
35	30	52.6	0.701	1.403	0.701	1816.0	1273.61	23.34	47.09
40	55	62.6	0.646	2.369	0.646	2129.0	1375.73	25.21	59.69

Boring B-2

Depth	N	Effective Unit weight (PCF)	Beta	Beta C	Corrected Beta	Sigma (PSF)	Unit Side Friction (PSF)	Ultimate Capacity (Kips)	Allowable Capacity (Kips)
1	22	52.6	1.250	1.833	1.250	52.6	65.75	0.24	0.12
3	32	52.6	1.266	2.701	1.266	157.8	199.80	1.46	0.85
5	18	52.6	1.198	1.438	1.198	263.0	315.11	2.31	2.01
7.5	7	47.6	1.130	0.527	0.527	382.0	201.49	1.85	2.93
10	17	52.6	1.073	1.216	1.073	513.5	551.03	5.05	5.46
15	9	47.6	0.977	0.586	0.586	751.5	440.60	8.07	9.49
20	20	52.6	0.896	1.195	0.896	1014.5	909.26	16.66	17.82
25	9	47.6	0.825	0.495	0.495	1252.5	619.99	11.36	23.50
30	26	52.6	0.761	1.318	0.761	1515.5	1152.65	21.12	34.06
35	9	47.6	0.701	0.421	0.421	1753.5	737.87	13.52	40.83
40	100	62.6	0.646	4.308	0.646	2066.5	1335.34	24.47	53.06

16-INCH DIAMETER AUGER CAST-IN-PLACE PILES

Boring B-1

Depth	N	Effective Unit weight (PCF)	Beta	Beta C	Corrected Beta	Sigma (PSF)	Unit Side Friction (PSF)	Ultimate Capacity (Kips)	Allowable Capacity (Kips)
1	36	52.6	1.250	3.000	1.250	52.6	65.75	0.28	0.14
3	38	52.6	1.266	3.208	1.266	157.8	199.80	1.67	0.97
5	16	52.6	1.198	1.278	1.198	263.0	315.11	2.64	2.29
7.5	9	47.6	1.130	0.678	0.678	382.0	259.06	2.71	3.65
10	8	47.6	1.073	0.572	0.572	501.0	286.73	3.00	5.15
15	10	52.6	0.977	0.651	0.651	764.0	497.69	10.42	10.36
20	14	52.6	0.896	0.837	0.837	1027.0	859.10	17.99	19.36
25	14	52.6	0.825	0.770	0.770	1290.0	993.30	20.80	29.76
30	13	52.6	0.761	0.659	0.659	1553.0	1023.68	21.44	40.48
35	30	52.6	0.701	1.403	0.701	1816.0	1273.61	26.67	53.82
40	55	62.6	0.646	2.369	0.646	2129.0	1375.73	28.81	68.23

Boring B-2

Depth	N	Effective Unit weight (PCF)	Beta	Beta C	Corrected Beta	Sigma (PSF)	Unit Side Friction (PSF)	Ultimate Capacity (Kips)	Allowable Capacity (Kips)
1	22	52.6	1.250	1.833	1.250	52.6	65.75	0.28	0.14
3	32	52.6	1.266	2.701	1.266	157.8	199.80	1.67	0.97
5	18	52.6	1.198	1.438	1.198	263.0	315.11	2.64	2.29
7.5	7	47.6	1.130	0.527	0.527	382.0	201.49	2.11	3.35
10	17	52.6	1.073	1.216	1.073	513.5	551.03	5.77	6.23
15	9	47.6	0.977	0.586	0.586	751.5	440.60	9.23	10.85
20	20	52.6	0.896	1.195	0.896	1014.5	909.26	19.04	20.37
25	9	47.6	0.825	0.495	0.495	1252.5	619.99	12.99	26.86
30	26	52.6	0.761	1.318	0.761	1515.5	1152.65	24.14	38.93
35	9	47.6	0.701	0.421	0.421	1753.5	737.87	15.45	46.66
40	100	62.6	0.646	4.308	0.646	2066.5	1335.34	27.97	60.64

Auger Cast-in-Place Pile Foundation
Influent Structure
 Northeast REgion Wastewater Treatment Plant
 Manatee County, Florida

18-INCH DIAMETER AUGER CAST-IN-PLACE PILES

Boring B-1

Depth	N	Effective Unit weight (PCF)	Beta	Beta C	Corrected Beta	Sigma (PSF)	Unit Side Friction (PSF)	Ultimate Capacity (Kips)	Allowable Capacity (Kips)
1	36	52.6	1.250	3.000	1.250	52.6	65.75	0.31	0.15
3	38	52.6	1.266	3.208	1.266	157.8	199.80	1.88	1.10
5	16	52.6	1.198	1.278	1.198	263.0	315.11	2.97	2.58
7.5	9	47.6	1.130	0.678	0.678	382.0	259.06	3.05	4.11
10	8	47.6	1.073	0.572	0.572	501.0	286.73	3.38	5.80
15	10	52.6	0.977	0.651	0.651	764.0	497.69	11.73	11.66
20	14	52.6	0.896	0.837	0.837	1027.0	859.10	20.24	21.78
25	14	52.6	0.825	0.770	0.770	1290.0	993.30	23.40	33.48
30	13	52.6	0.761	0.659	0.659	1553.0	1023.68	24.12	45.54
35	30	52.6	0.701	1.403	0.701	1816.0	1273.61	30.01	60.54
40	55	62.6	0.646	2.369	0.646	2129.0	1375.73	32.41	76.75

Boring B-2

Depth	N	Effective Unit weight (PCF)	Beta	Beta C	Corrected Beta	Sigma (PSF)	Unit Side Friction (PSF)	Ultimate Capacity (Kips)	Allowable Capacity (Kips)
1	22	52.6	1.250	1.833	1.250	52.6	65.75	0.31	0.15
3	32	52.6	1.266	2.701	1.266	157.8	199.80	1.88	1.10
5	18	52.6	1.198	1.438	1.198	263.0	315.11	2.97	2.58
7.5	7	47.6	1.130	0.527	0.527	382.0	201.49	2.37	3.77
10	17	52.6	1.073	1.216	1.073	513.5	551.03	6.49	7.01
15	9	47.6	0.977	0.586	0.586	751.5	440.60	10.38	12.20
20	20	52.6	0.896	1.195	0.896	1014.5	909.26	21.42	22.91
25	9	47.6	0.825	0.495	0.495	1252.5	619.99	14.61	30.22
30	26	52.6	0.761	1.318	0.761	1515.5	1152.65	27.16	43.80
35	9	47.6	0.701	0.421	0.421	1753.5	737.87	17.38	52.49
40	100	62.6	0.646	4.308	0.646	2066.5	1335.34	31.46	68.22

APPENDIX E

Driven Pile Capacity Calculations

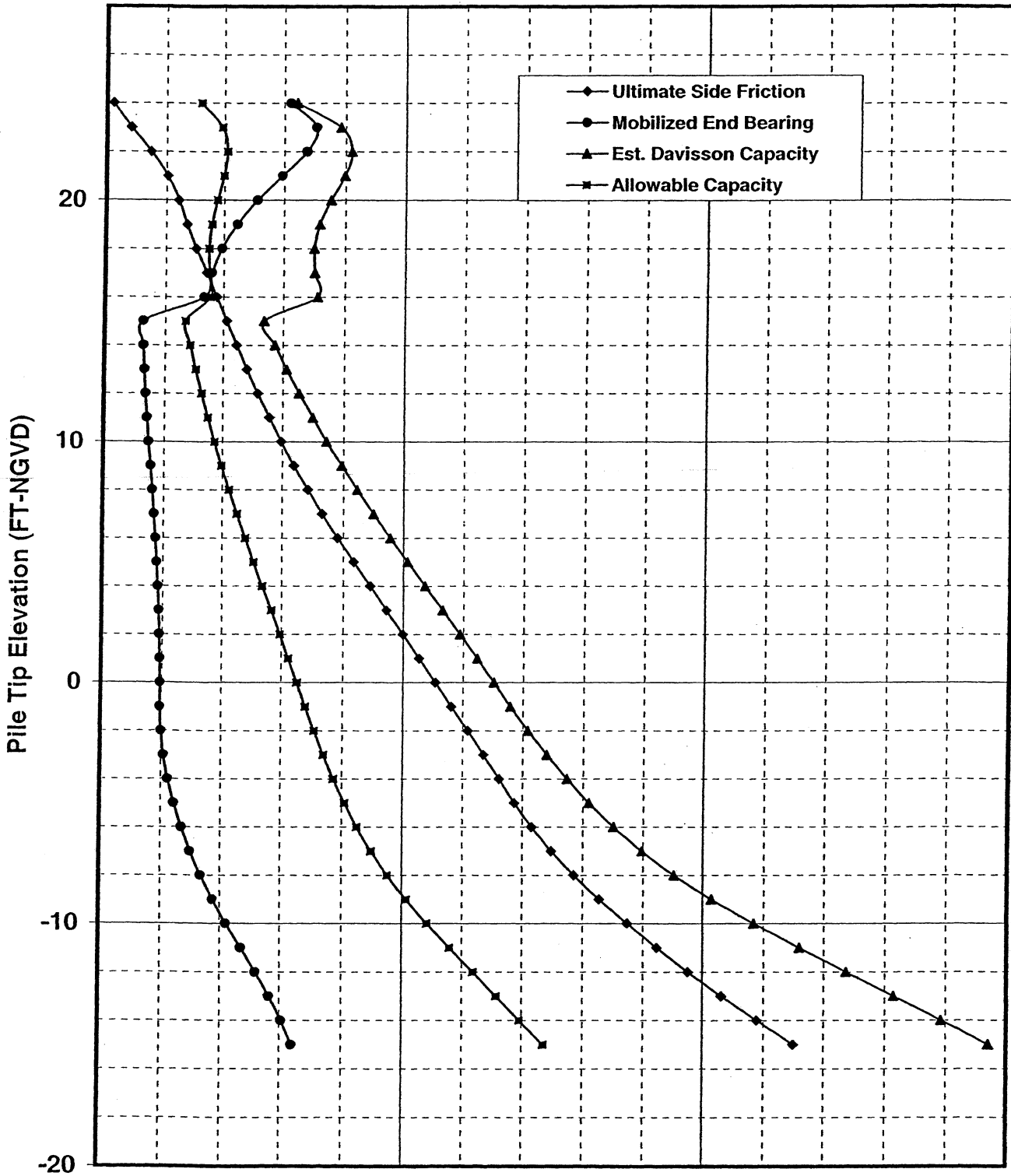
Pile Capacity (tons)

0

50

100

150



HEADWORKS

Boring B-1

Top Elevation 25.0 FT-NGVD

14-Inch PSC

PILE CAPACITY VS. DEPTH

BORING: B-2 BRIDGE: LOCATION: Headworks BORING ELEVATION: 25

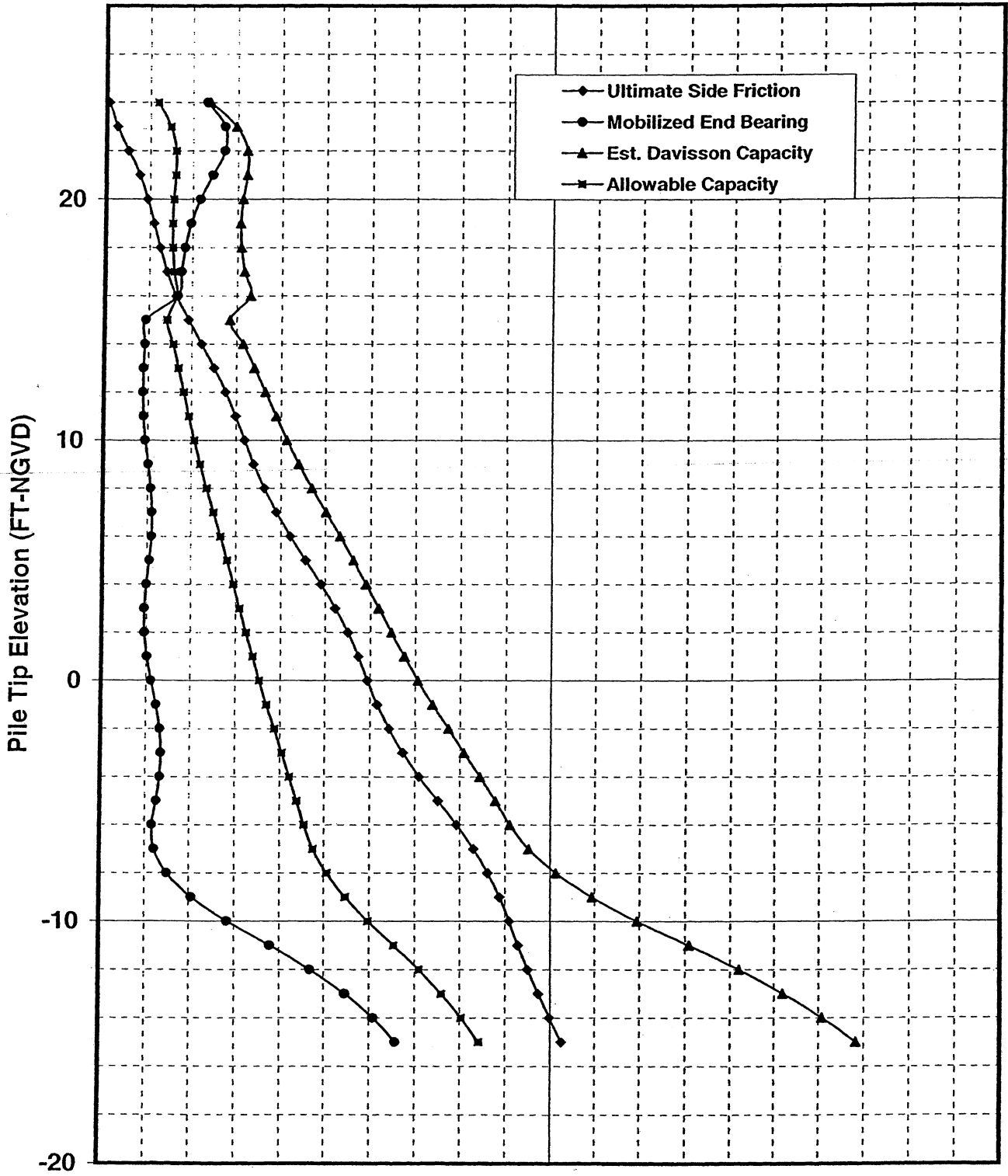
Tip Elevation (FT - NGVD)	Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)	Est. Davisson Capacity With PDA (tons)	Est. Davisson Capacity With Static Load Test (tons)
24	1	14	1.06	31.08	32.14	16.07	94.3	21.9	21.9
23	2	14	4	35.23	39.24	19.62	109.7	25.5	25.4
22	3	14	7.32	33.71	41.03	20.51	108.46	26.7	30.8
21	4	14	10.2	29.71	39.91	19.95	99.32	25.9	29.9
20	5	14	12.1	25.6	37.7	18.85	88.89	24.5	28.8
19	6	14	13.61	22.24	35.85	17.92	80.33	23.6	26.9
18	7	14	15.29	19.7	34.99	17.49	74.39	22.7	26.2
17	8	14	17.11	17.97	35.07	17.54	71	22.8	26.3
16	9	14	18.88	16.69	35.58	17.79	68.96	22.9	26.7
15	10	14	20.58	6.29	26.87	13.43	39.44	17.5	21.2
14	11	14	22.28	6.4	28.68	14.34	41.48	18.6	21.5
13	12	14	24.05	6.58	30.63	15.32	43.8	19.9	21.9
12	13	14	25.9	6.82	32.72	16.36	46.36	21.3	22.5
11	14	14	27.83	7.1	34.93	17.46	49.13	22.7	23.2
10	15	14	29.83	7.43	37.25	18.63	52.11	24.2	23.9
9	16	14	31.93	7.79	39.72	19.86	55.29	25.6	23.9
8	17	14	34.18	8.12	42.3	21.15	58.54	27.1	24.7
7	18	14	36.57	8.42	44.99	22.5	61.84	28.2	25.7
6	19	14	39.09	8.7	47.8	23.9	65.21	29.4	25.9
5	20	14	41.76	8.95	50.71	25.36	68.62	30.7	26.9
4	21	14	44.5	9.17	53.67	26.83	72	31.9	27.2
3	22	14	47.23	9.36	56.59	28.3	75.31	33.2	27.4
2	23	14	49.97	9.51	59.48	29.74	78.51	34.5	27.5
1	24	14	52.71	9.64	62.34	31.17	81.62	35.8	27.6
0	25	14	55.44	9.72	65.17	32.58	84.61	37.1	27.7
-1	26	14	58.16	9.77	67.93	33.97	87.46	38.4	27.8
-2	27	14	60.85	9.96	70.81	35.4	90.72	39.7	27.9
-3	28	14	63.5	10.43	73.93	36.97	94.79	41.1	28.0
-4	29	14	66.12	11.18	77.3	38.65	99.67	42.5	28.1
-5	30	14	68.71	12.22	80.93	40.46	105.37	43.9	28.2
-6	31	14	71.51	13.48	84.99	42.49	111.96	45.2	28.3
-7	32	14	74.77	14.96	89.73	44.86	119.65	46.6	28.4
-8	33	14	78.5	16.71	95.21	47.6	128.63	48.0	28.5
-9	34	14	82.69	18.74	101.43	50.71	138.9	49.4	28.6
-10	35	14	87.34	21.04	108.38	54.19	150.46	50.8	28.7
-11	36	14	92.36	23.58	115.94	57.97	163.1	52.2	28.8
-12	37	14	97.63	26.07	123.69	61.85	175.83	53.6	28.9
-13	38	14	103.15	28.31	131.46	65.73	188.08	55.0	29.0
-14	39	14	108.93	30.31	139.24	69.62	199.87	56.4	29.1
-15	40	14	114.96	32.04	147	73.5	211.09	57.8	29.2

Pile Capacity (tons)

0

100

200



HEADWORKS

Boring B-2

Top Elevation 25.0 FT-NGVD

14-Inch PSC

PILE CAPACITY VS. DEPTH

BORING: B-2

BRIDGE:

LOCATION: Headworks

BORING ELEVATION:

25

Tip Elevation (FT - NGVD)	Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)	Est. Davisson Capacity With PDA (tons)	Est. Davisson Capacity with Static Load Test (tons)
24	1	14	0.65	23.31	23.96	11.98	70.57	15.6	130
23	2	14	2.51	27.13	29.64	14.82	83.9	19.3	122
22	3	14	5.05	27.11	32.16	16.08	86.39	20.9	124
21	4	14	7.58	24.54	32.12	16.06	81.2	21.9	123
20	5	14	9.49	21.74	31.23	15.62	74.72	20.7	119
19	6	14	11.06	19.66	30.72	15.36	70.03	20.0	117
18	7	14	12.58	18.29	30.86	15.43	67.44	20.1	117
17	8	14	14.14	17.48	31.62	15.81	66.58	20.6	117
16	9	14	16.31	16.72	33.03	16.51	66.47	21.5	118
15	10	14	19.18	9.34	28.52	14.26	47.2	18.5	114
14	11	14	22.26	9.2	31.46	15.73	49.85	20.4	116
13	12	14	25.07	8.93	33.99	17	51.85	22.1	117
12	13	14	27.6	8.85	36.45	18.23	54.14	23.7	118
11	14	14	29.87	9.02	38.89	19.45	56.94	25.3	119
10	15	14	31.85	9.49	41.35	20.67	60.34	26.9	120
9	16	14	33.89	10.18	44.07	22.03	64.43	28.6	121
8	17	14	36.28	10.78	47.06	23.53	68.63	30.3	122
7	18	14	39.04	11.15	50.19	25.09	72.49	32.0	123
6	19	14	42.16	11.06	53.22	26.61	75.33	33.8	124
5	20	14	45.65	10.55	56.19	28.1	77.29	35.6	124
4	21	14	49.13	9.9	59.03	29.51	78.83	37.4	125
3	22	14	52.25	9.51	61.76	30.88	80.79	39.1	126
2	23	14	55.01	9.6	64.61	32.31	83.82	40.9	127
1	24	14	57.4	10.17	67.57	33.79	87.91	42.9	127
0	25	14	59.44	11.17	70.61	35.3	92.95	45.0	128
-1	26	14	61.55	12.37	73.92	36.96	98.66	47.0	129
-2	27	14	64.18	13.27	77.44	38.72	103.97	49.0	130
-3	28	14	67.33	13.6	80.93	40.46	108.13	50.6	130
-4	29	14	70.99	13.38	84.38	42.19	111.14	52.0	130
-5	30	14	75.18	12.64	87.82	43.91	113.1	53.4	130
-6	31	14	79.37	11.68	91.05	45.53	114.42	54.7	130
-7	32	14	83.04	12.15	95.19	47.6	119.49	56.9	131
-8	33	14	86.19	15.12	101.3	50.65	131.54	60.0	131
-9	34	14	88.82	20.58	109.39	54.7	150.55	64.0	131
-10	35	14	90.93	28.48	119.41	59.71	176.38	68.0	131
-11	36	14	92.88	37.96	130.83	65.42	206.75	72.0	131
-12	37	14	95.01	46.98	141.99	71	235.96	76.0	131
-13	38	14	97.34	54.61	151.95	75.97	261.18	80.0	131
-14	39	14	99.85	60.85	160.7	80.35	282.41	84.0	131
-15	40	14	102.56	65.76	168.31	84.16	299.83	88.0	131

APPENDIX F

FHWA Geotechnical Report Review Checklist

"GTR REVIEW CHECKLIST" (SITE INVESTIGATION)

A. Site Investigation Information

Since the most important step in the geotechnical design process is the conduct of an adequate site investigation, presentation of the subsurface information in the geotechnical report and on the plans deserves careful attention.

<u>Geotechnical Report Text (Introduction) (Pages 322-325)</u>	<u>Yes</u>	<u>No</u>	<u>Unknown or N/A</u>
1. Is the general location of the investigation described and/or a vicinity map included?	✓ —	—	—
2. Is scope and purpose of the investigation summarized?	✓ —	—	—
3. Is concise description given of geologic setting and topography of area?	—	—	✓ —
4. Are the field explorations and laboratory tests on which the report is based listed?	✓ —	—	—
5. Is general description of subsurface soil, rock, and groundwater conditions given?	✓ —	—	—
*6. Is the following information included with the geotechnical report (typically included in report appendices):	—	—	—
a. Test hole logs? (Pages 25-33)	✓ —	—	—
b. Field test data?	✓ —	—	—
c. Laboratory test data? (Pages 74-75)	✓ —	—	—
d. Photographs (if pertinent)?	—	—	✓ —
 <u>Plan and Subsurface Profile (Pages 24, 47-49, 335)</u>			
*7. Is a plan and subsurface profile of the investigation site provided?	✓ —	—	—

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

A. <u>Site Investigation Information (Cont.)</u>	<u>Yes</u>	<u>No</u>	<u>Unknown or N/A</u>
8. Are the field explorations located on the plan view?	✓	—	—
*9. Does the conducted site investigation meet minimum criteria outlined in Table 2?	—	—	✓
10. Are the explorations plotted and correctly numbered on the profile at their true elevation and location?	—	—	✓
11. Does the subsurface profile contain a word description and/or graphic depiction of soil and rock types?	✓	—	—
12. Are groundwater levels and date measured shown on the subsurface profile?	✓	—	—
<u>Subsurface Profile or Field Boring Log (Pages 16-17, 25-29)</u>			
13. Are sample types and depths noted?	✓	—	—
*14. Are SPT blow counts, percent core recovery, and RQD values shown?	✓	—	—
15. If cone penetration tests were made, are plots of cone resistance and friction ratio shown with depth?	—	—	✓
<u>Laboratory Test Data (Pages 60, 74-75)</u>			
*16. Were lab soil classification tests such as natural moisture content, gradation, Atterberg limits, performed on selected representative samples to verify field visual soil identifications?	✓	—	—
17. Are laboratory test results such as shear strength (Page 62), consolidation (Page 68), etc , included and/or summarized?	—	—	✓

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

